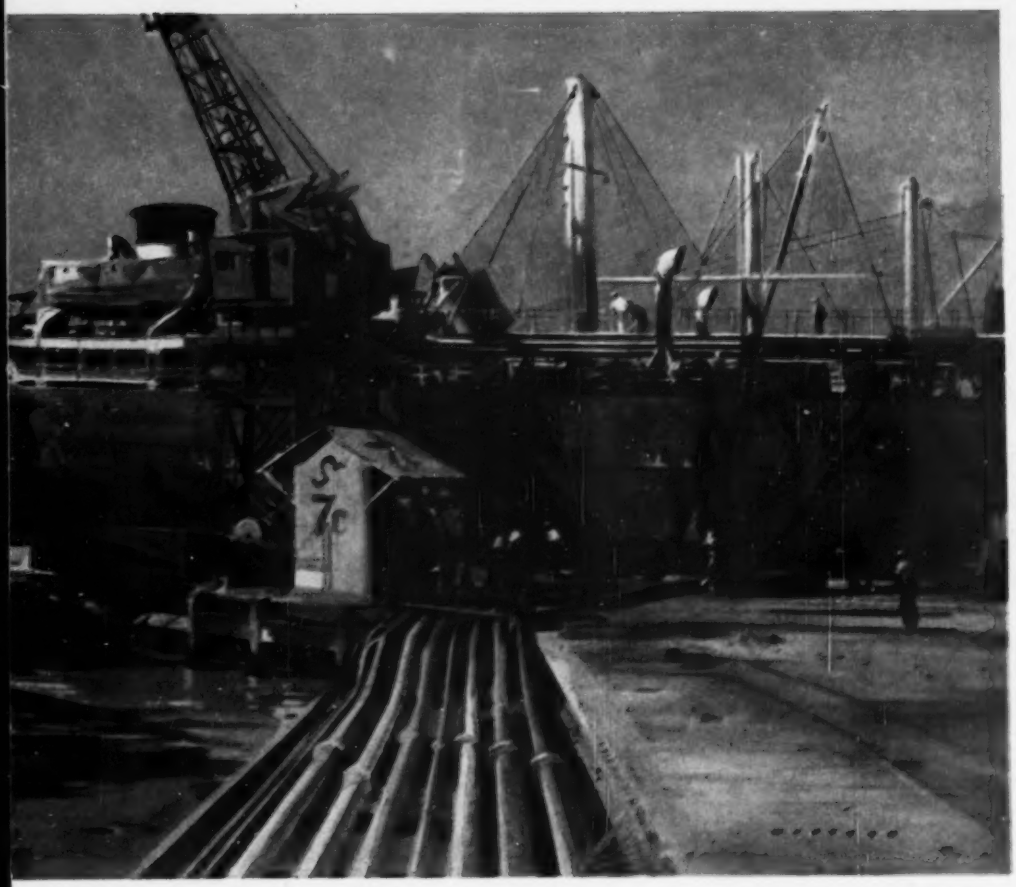
# World Petroleum



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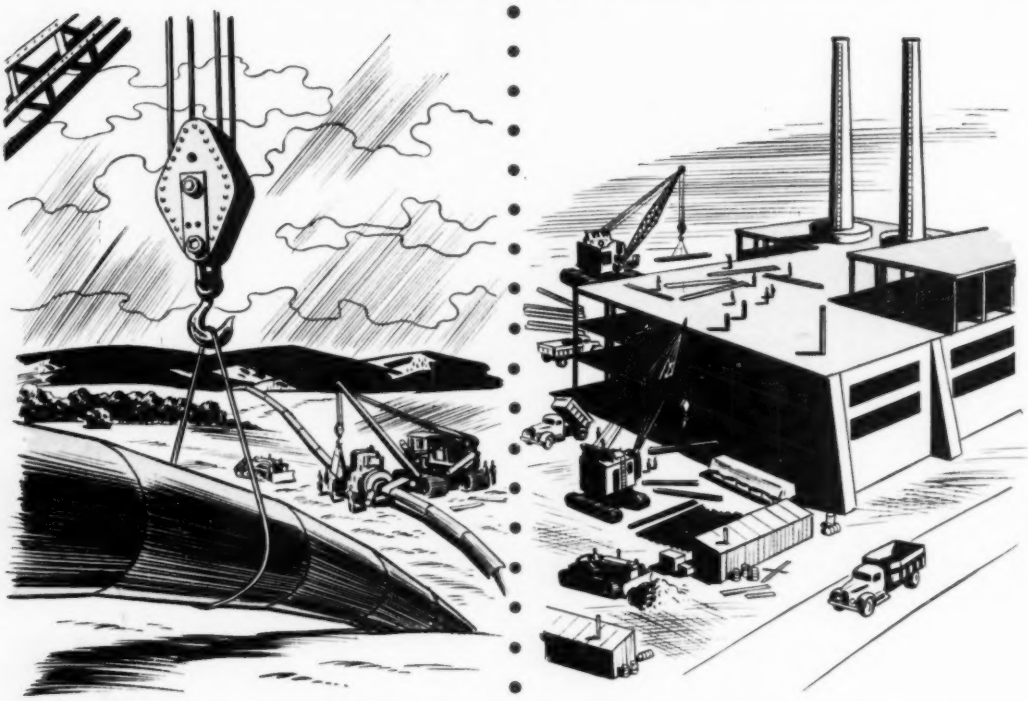
April, 1949

# FROM PIPE LINES TO PAPER PLANTS



## BROWN & ROOT is geared to do the job BEST!

**Whether your project calls for a pipe line or paper plant — refinery or chemical plant, Brown & Root is prepared to meet your exacting demands efficiently. Thirty-five years' experience in the industrial engineering and construction field assures clients the finest in planning, process analysis, architectural, and engineering skill.**

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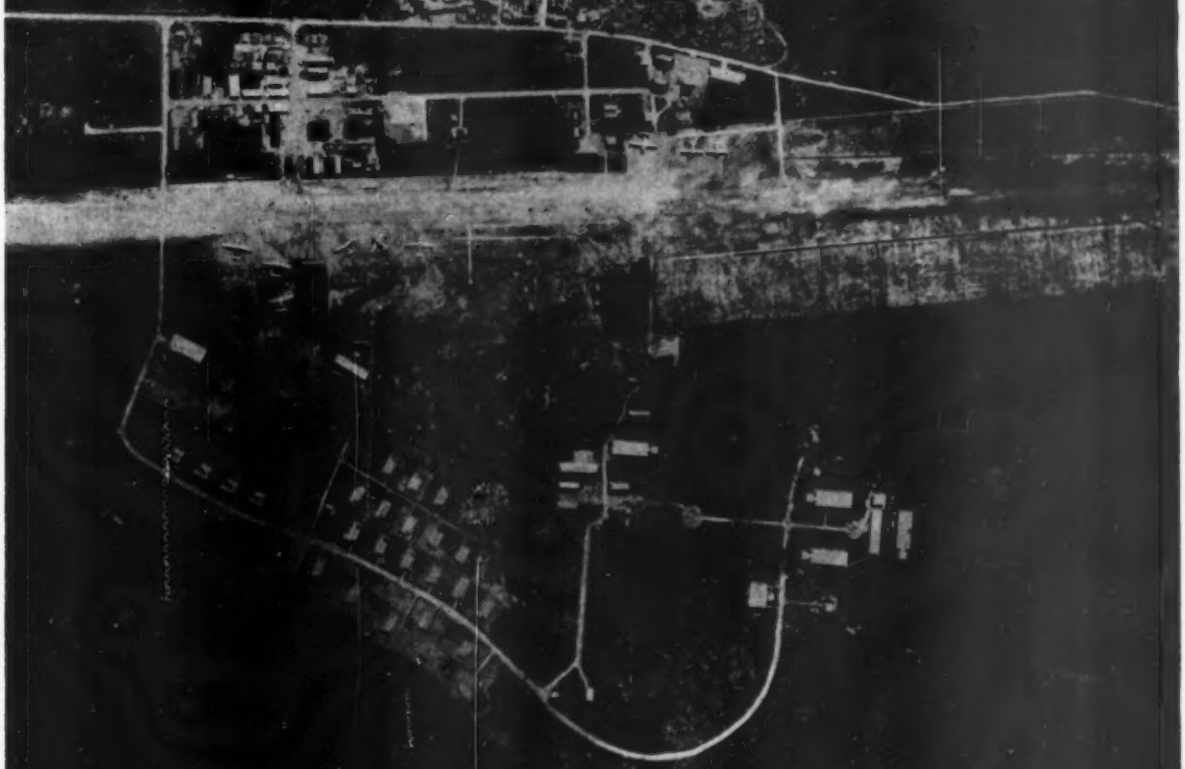

To no single industry does the use of aircraft present such revolutionary possibilities as it does to oil drilling. Remotely sited or inaccessible workings can be reached in minutes or hours instead of days or weeks. Air transport for key technicians and urgently needed spares reduces production hold-ups to a minimum. Speedy despatch of medical supplies, availability of air ambulance services, establishes close touch with civilization. Daily supplies of hitherto unobtainable fresh foods, by maintaining fitness, increase output. Surveys and inspections are completed in a fraction of the time. In short, air transport by very considerably reducing the all important time factor when applied to "key" problems, increases output and, where weather is a limiting factor, may increase the number of working days. *In some cases, even one light aeroplane would serve the purpose!* But air transport, when reliable and economical, is a science in itself, whether for a fleet, or for a single aircraft. In whatever part of the world, Airwork Limited can provide the organisation for efficient and economic operation of your own air transport. Airwork Limited, the founders of Heston Airport, are the largest British Air Transport Contractors specialising in these problems since 1929.

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NOW as never before, America stands at a cross-roads. One road is the way of easy promises by which we hope to arrive in the Never-never land of abundance for all and hardship for none.

The other way looks very much like the road we have traveled--the way that built America into the richest, strongest, most envied nation of all time. It is the road built by enterprise and resourcefulness and hard work--and thrift.

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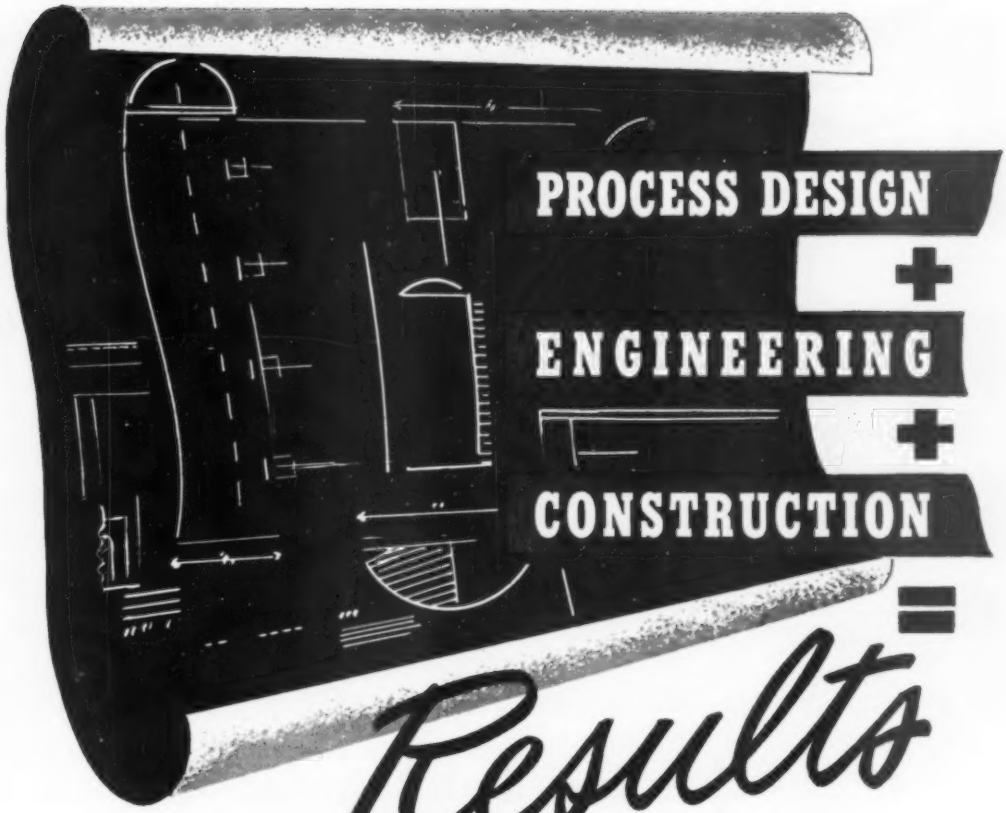

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**HIGH STRENGTH TO WEIGHT RATIO** makes alloy steels vital to airplane manufacturers. From landing gear struts to motor parts and crankshafts, the strength and comparative light weight of alloy steels make them indispensable.

**RESISTANCE TO WEAR.** Trucks that do heavy duty need parts that resist wear. Axles, bearings, gears and universal joints are only a few of the truck parts that are made better with alloy steels.

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A wide range of uses includes those pictured at the left, as well as gears, shafts, locomotive forgings, power drills, stud bolts, wrenches . . . in fact, all parts that must be hard and strong.

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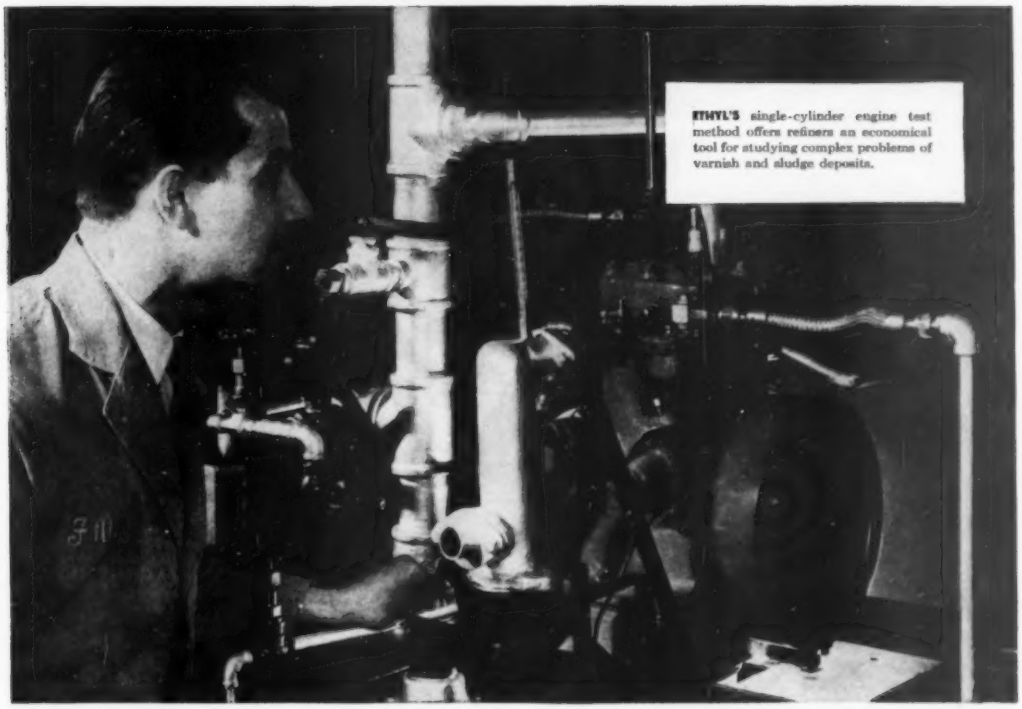


**ETHYL'S** single-cylinder engine test method offers refiners an economical tool for studying complex problems of varnish and sludge deposits.

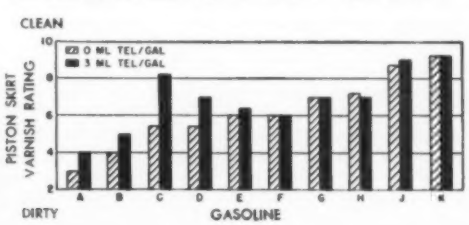
# Exploring Engine Cleanliness

Recognizing engine cleanliness as part of the over-all problem of engines, fuels and lubricants, the Ethyl Laboratories have worked extensively in helping to build up a background of information on the factors contributing to the formation of varnish and sludge.

This work has accented the need for an economical test method which could be used for screening and preliminary tests.

An important contribution of Ethyl's research has been the development of a test method that permits the use of a smaller engine. This new test method requires fewer over-all man hours of work, does not involve expensive dynamometer equipment, and uses only fourteen gallons of gasoline—a real advantage in research on experimental fuels. The results obtained by these two methods are comparable.

Ethyl's comprehensive and continuous research program provides information that assists refiners directly in the economical production of satisfactory gasoline and furnishes basic data which serve as a foundation for development programs related to gasolines, engines, and crankcase oils.




Research on ten different fuels showed that the addition of "Ethyl" antiknock compound tended to reduce varnish deposits on piston skirts.

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## HOW KELLOGG CUT LINING COSTS BY OVER 50%

For many years, accepted practice has been to line regenerators with refractory tile and block insulation costing from $10 to $12 a square foot installed.

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This story of Kelcrete underlines just *one* of the ever present opportunities for paring the initial cost of new refinery units—opportunities available only to the resourceful engineer-contractor who has a complete organization... one that *supplies within itself* all the requisites for obtaining unbiased solutions to initial-cost-vs.-earning-power problems.

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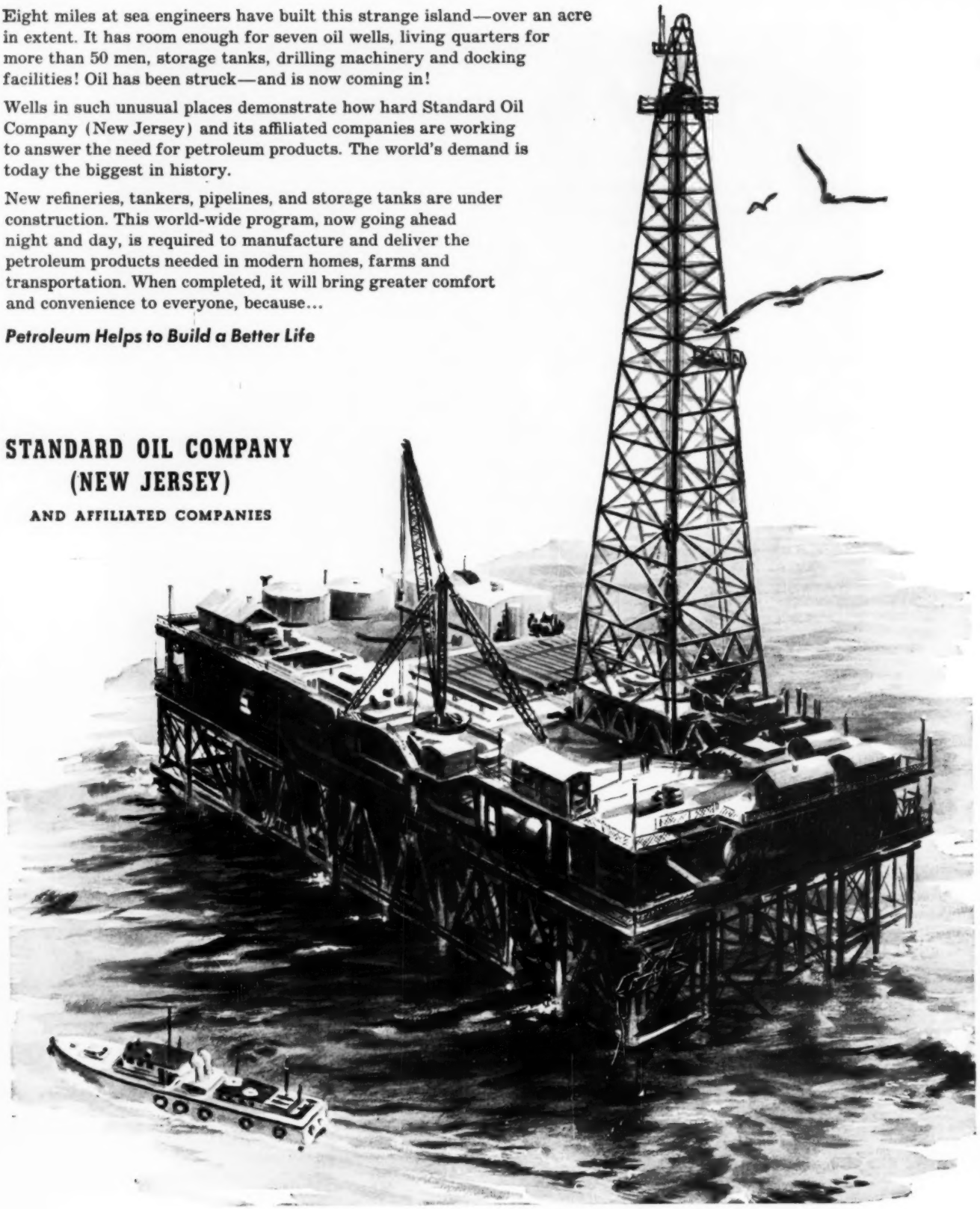

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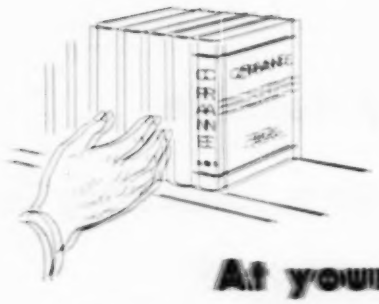

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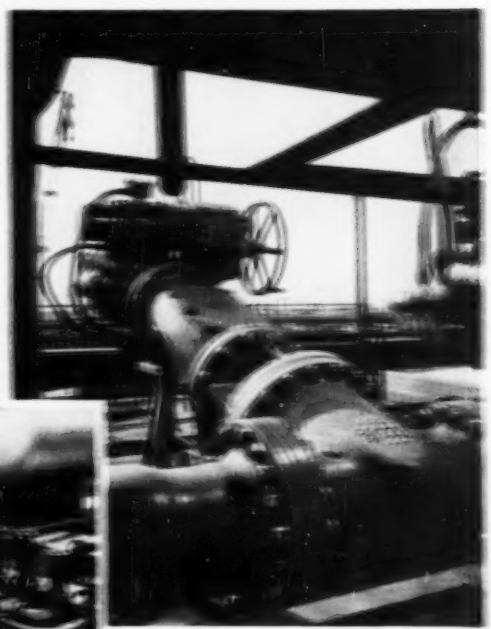

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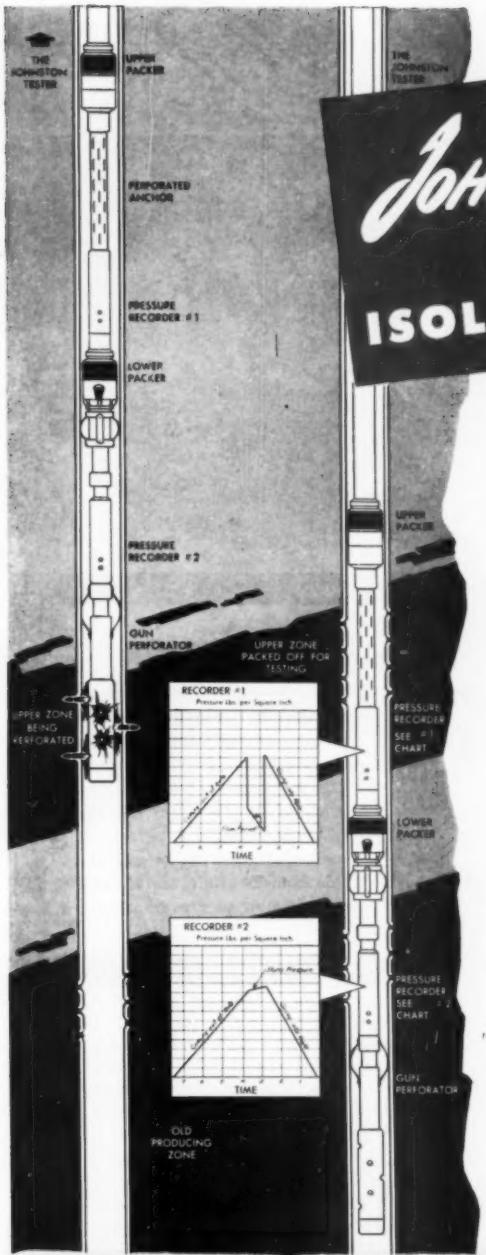


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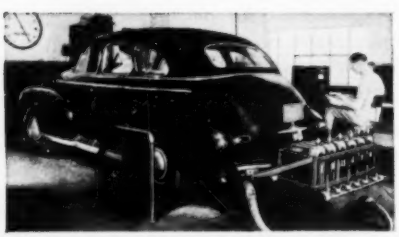

*Car on modern chassis dynamometer originated by Texaco which approximates road-driving conditions in the laboratory.*

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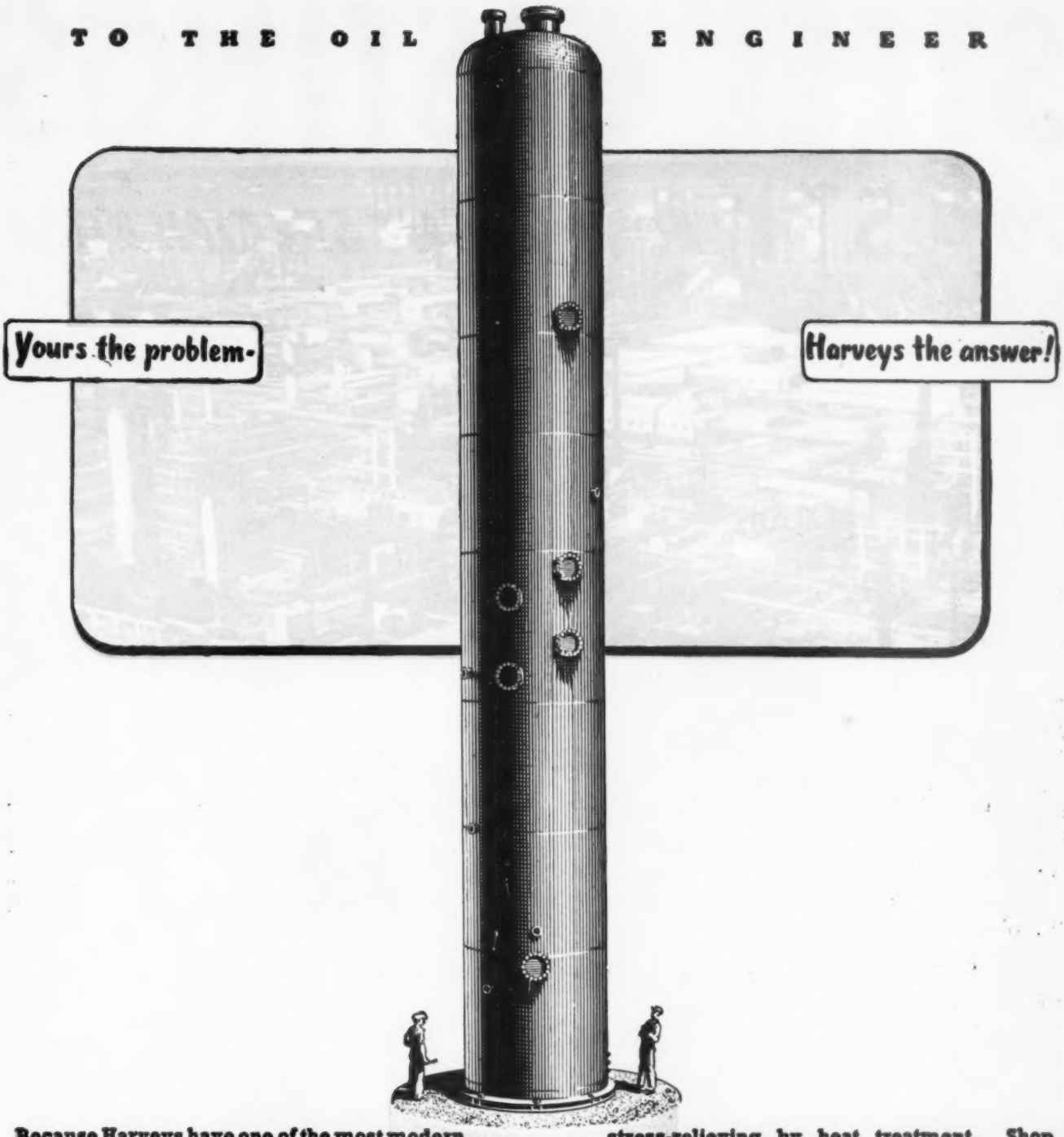
***Petroleum Promotes Progress***

TO THE OIL ENGINEER

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Send for Catalogue WP 750.

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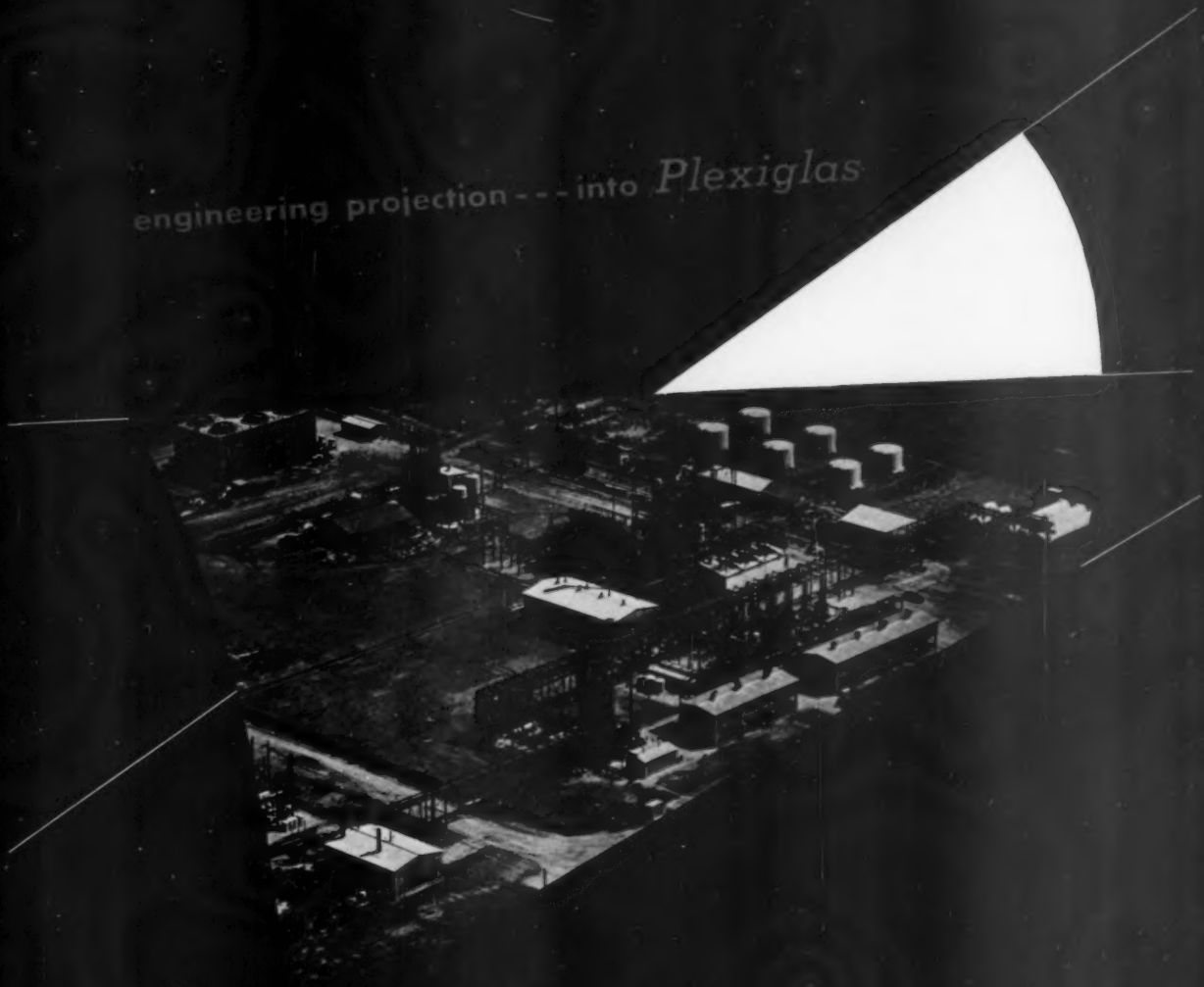

Producing "Plexiglas intermediates", products of a new catalytic synthesis process, this complete chemical plant represents the collaboration of the Rohm & Haas Company who supplied the basic process design data, and the Foster Wheeler Corporation who provided mechanical design, engineering, and construction.

FOSTER WHEELER CORPORATION

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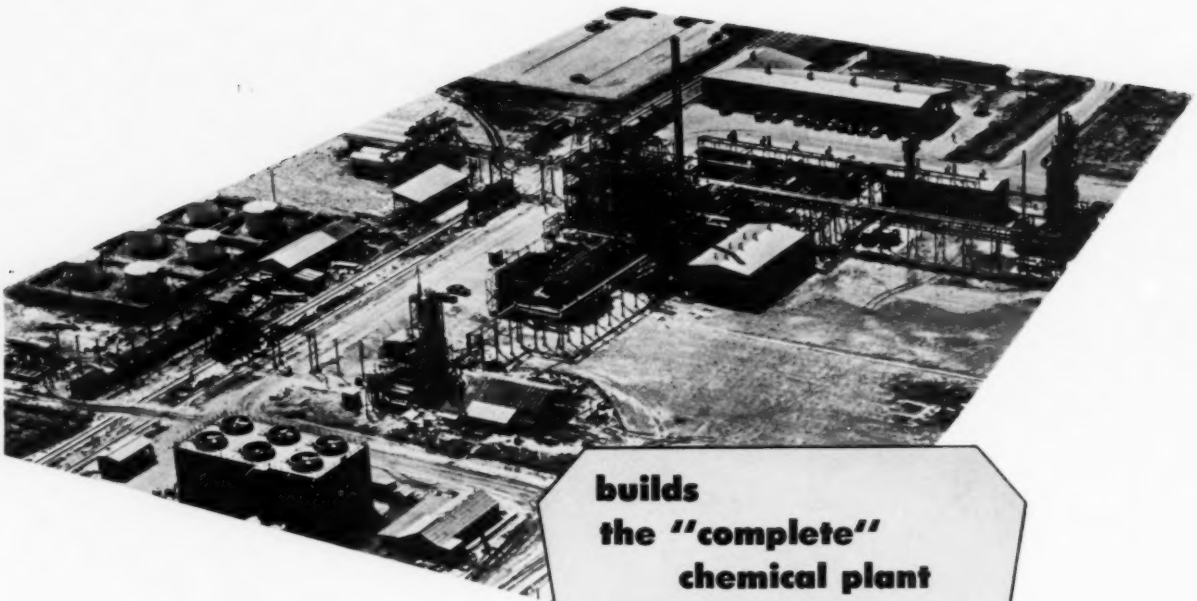
## the "complete" engineering service . . .



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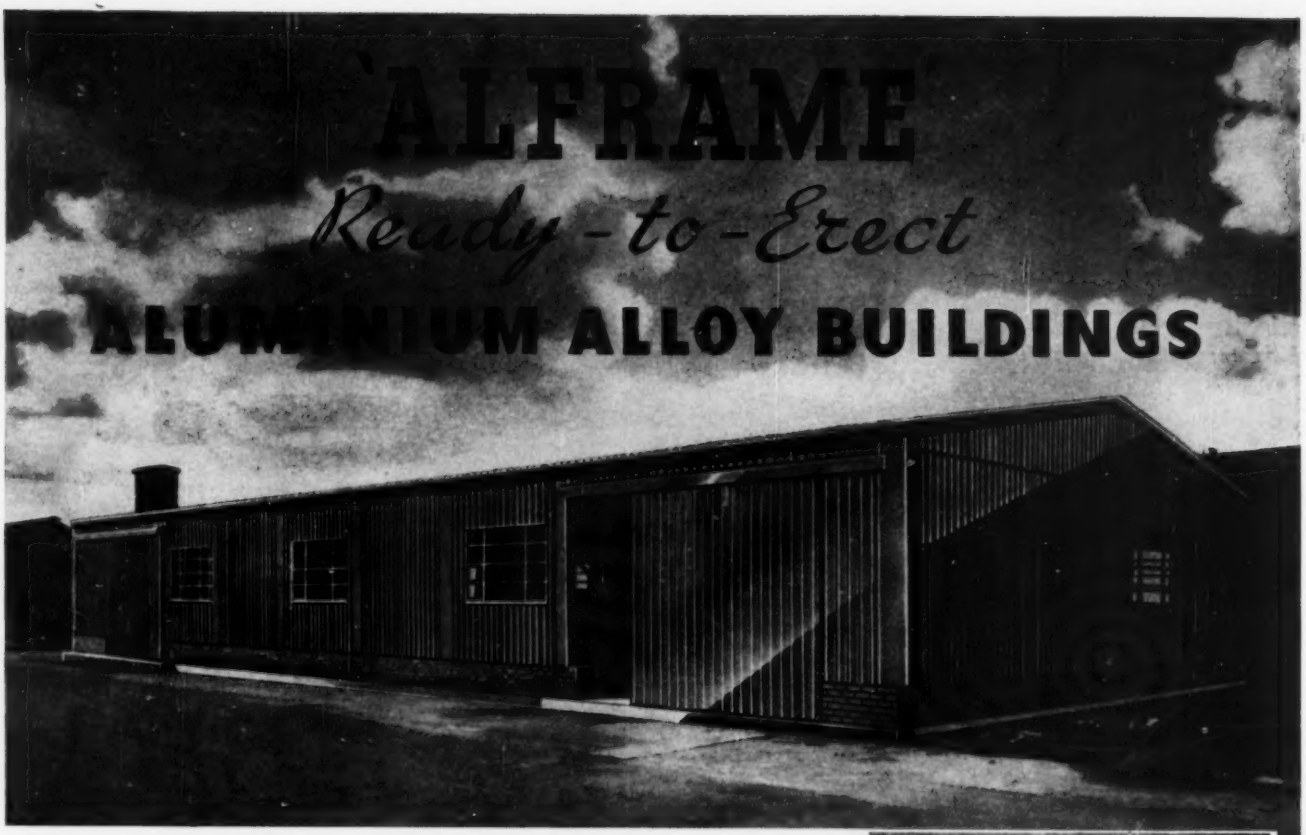


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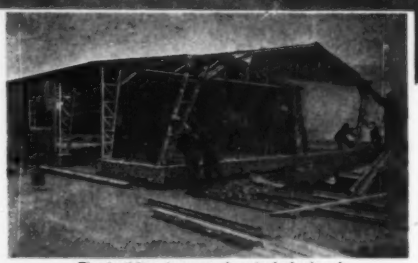

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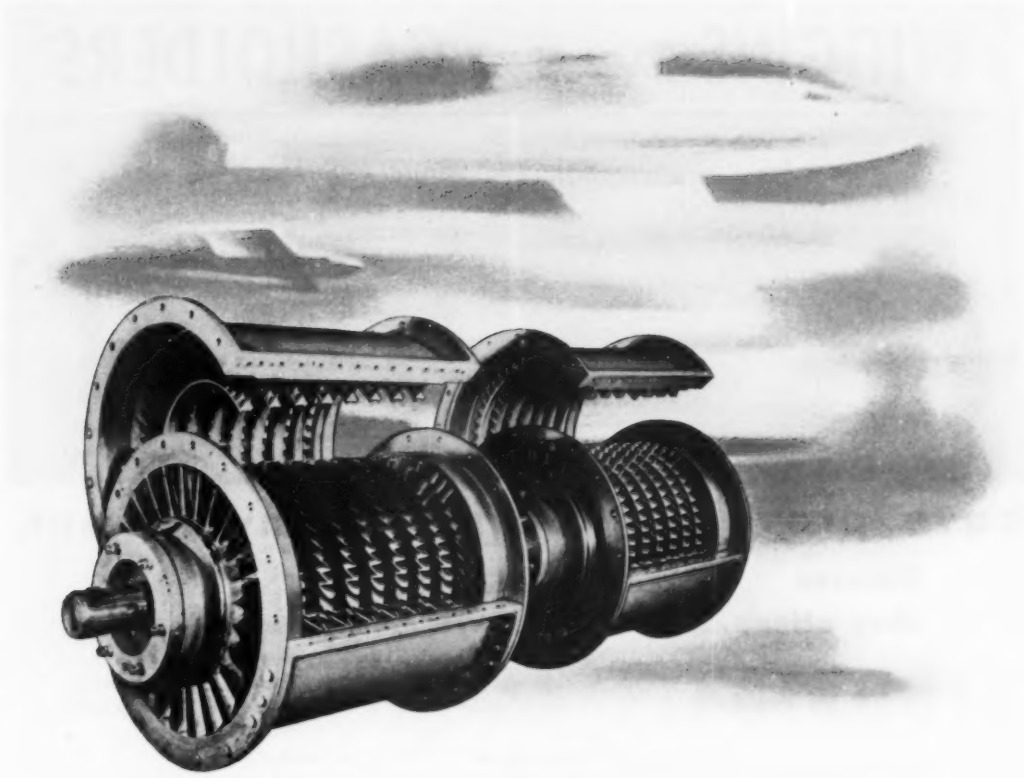

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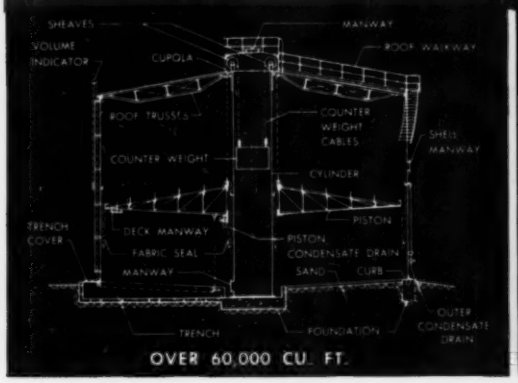
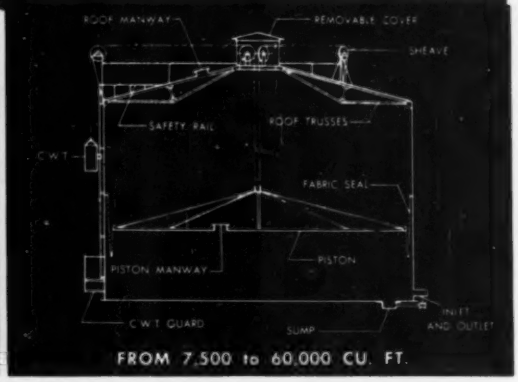



OVER 60,000 CU. FT.

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e. A Gasholder working pressure of ⅛ to ¼ inch of water.

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**3. One vapor balancing mechanism for all tanks.**

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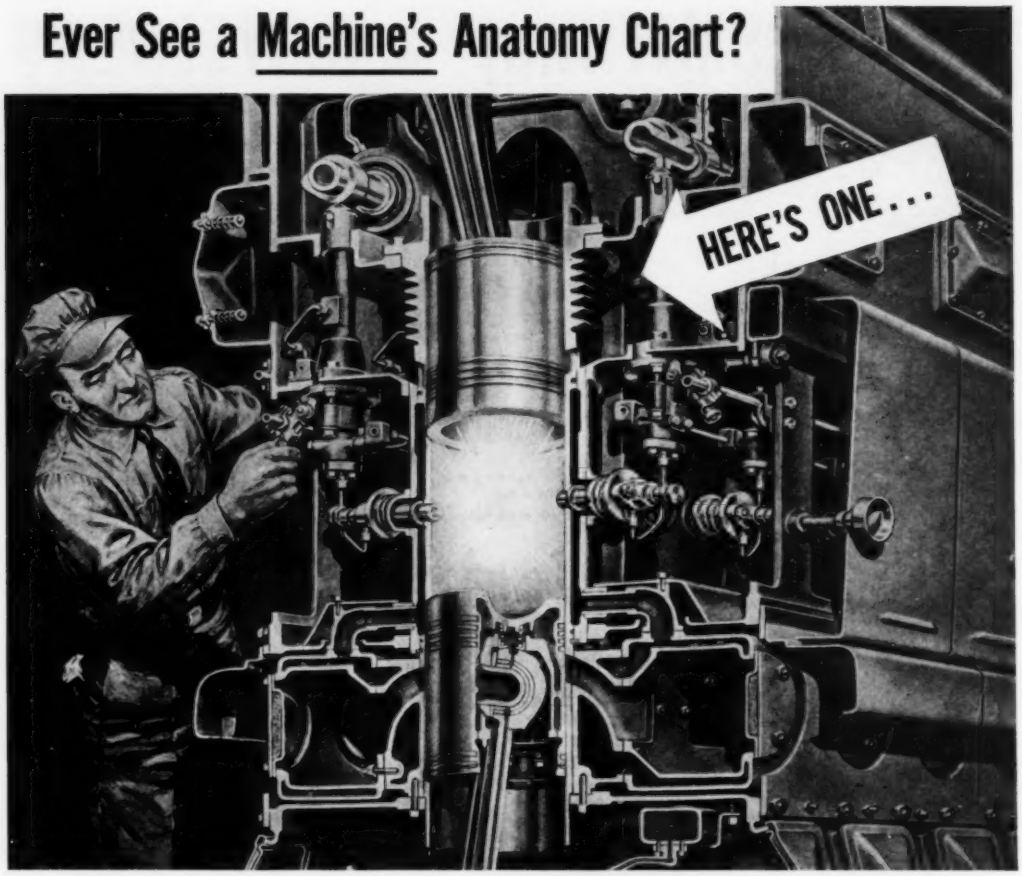


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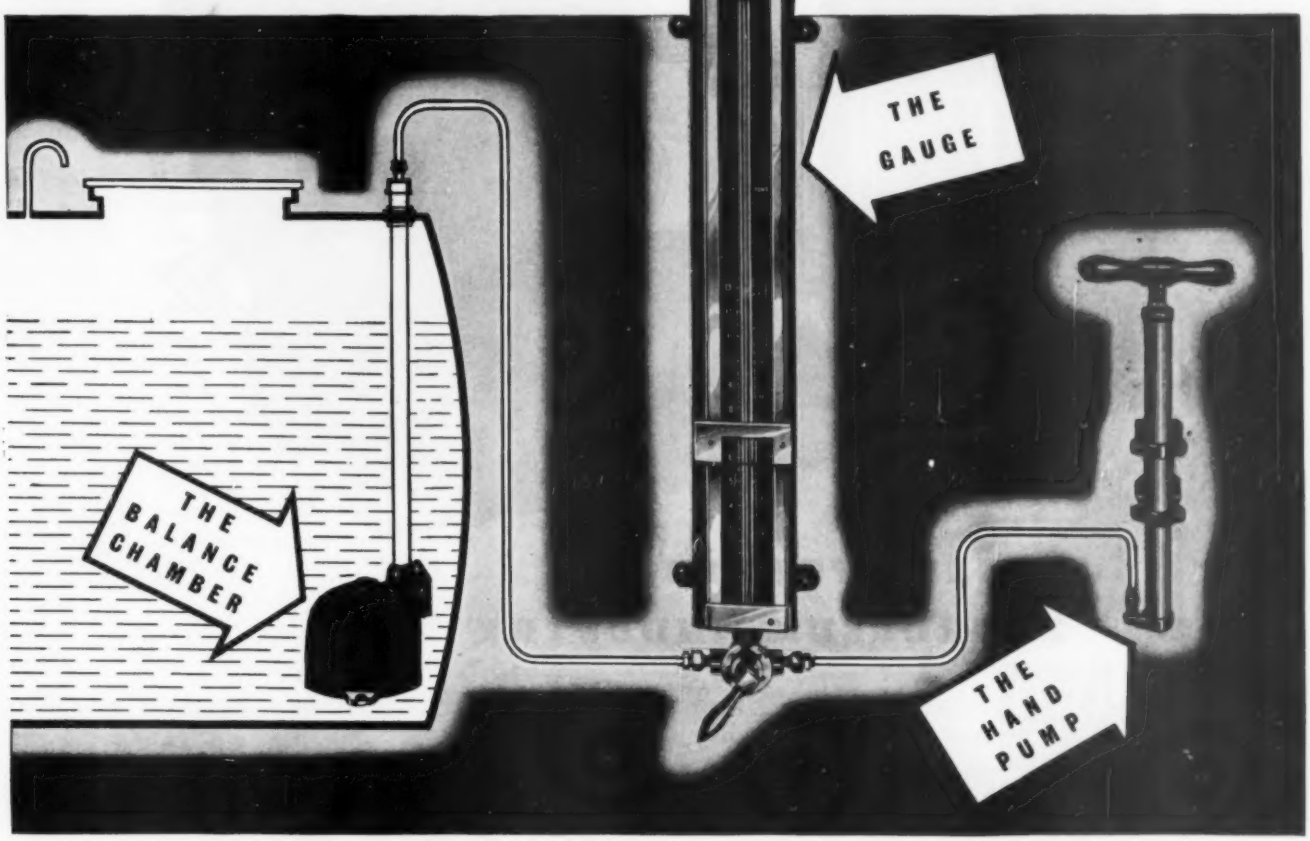


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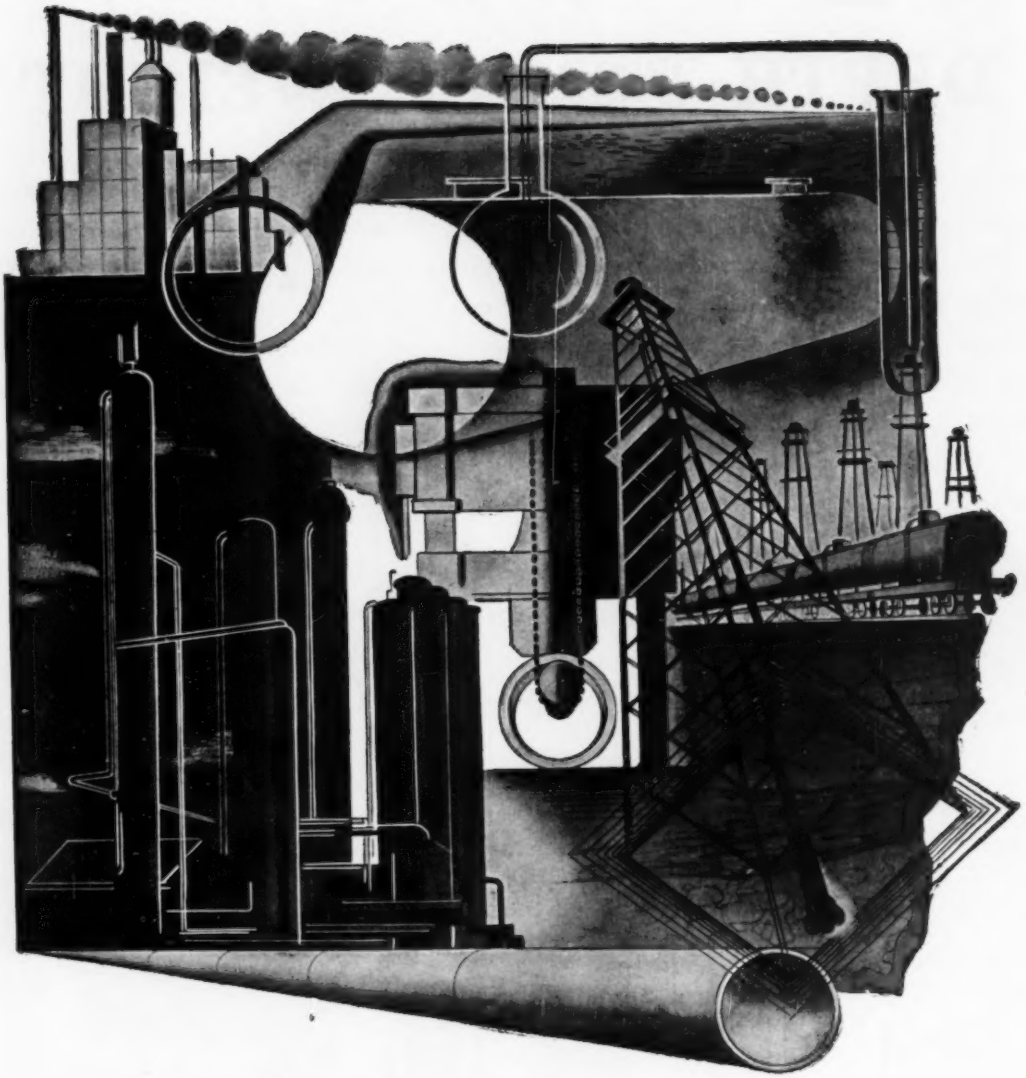

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The purpose of this letter is to tell you about the excellent motor performance we have had from this engine It is on a 24-hour operation, and since being installed, it has operated 56,232 hours, and to date the head or motor pan have never been removed The engine is still operating with the original main and connecting rod bearings, sleeves, pistons and valves The valve tappets were adjusted once during these 6-1/2 years operation We feel this is a splendid record for your engine

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We are interested in dependable power and operating at a low cost We believe you have that in your International Power Units and your International Trucks which we also use

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Mike Kadane

MK jk

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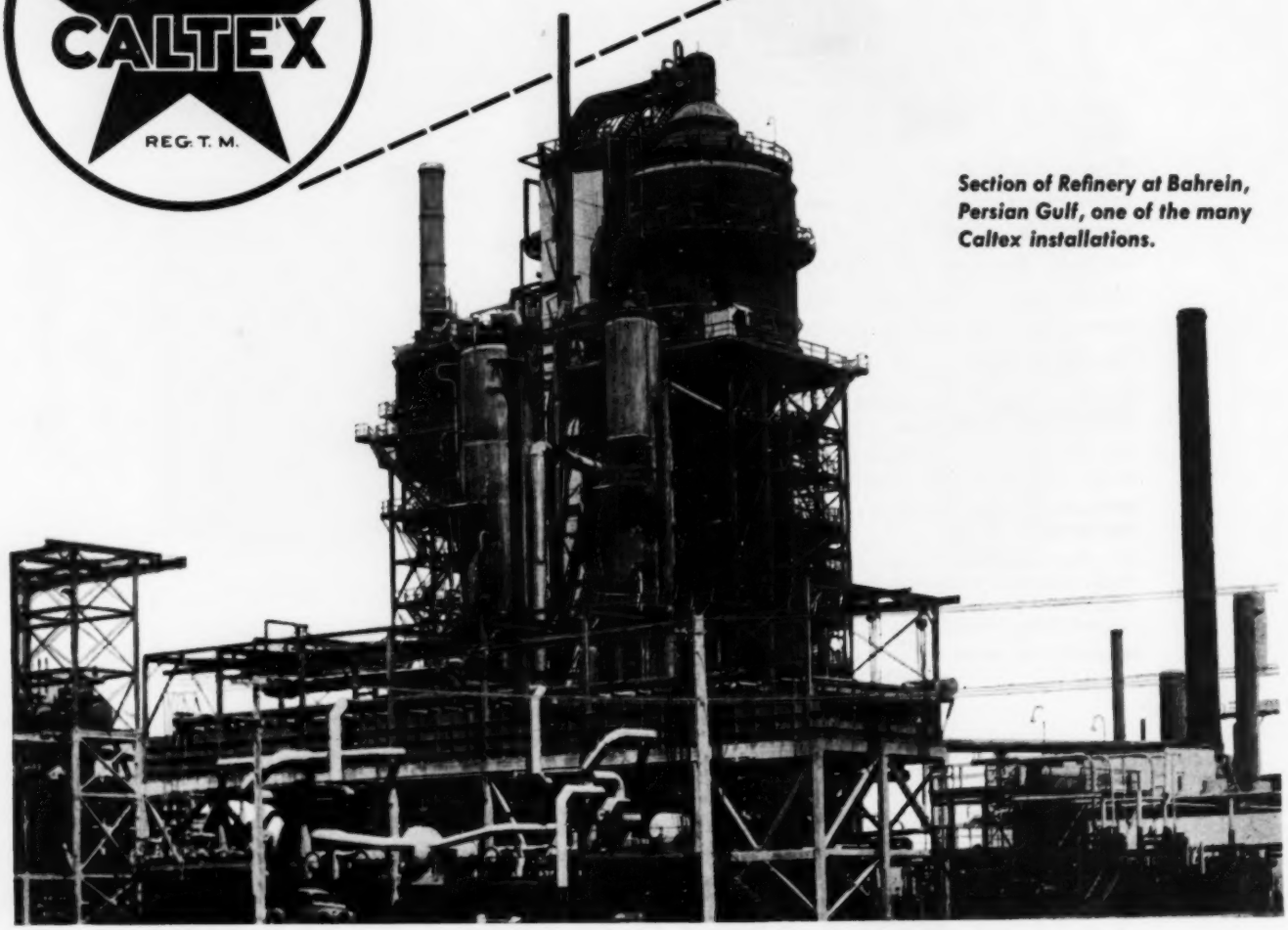

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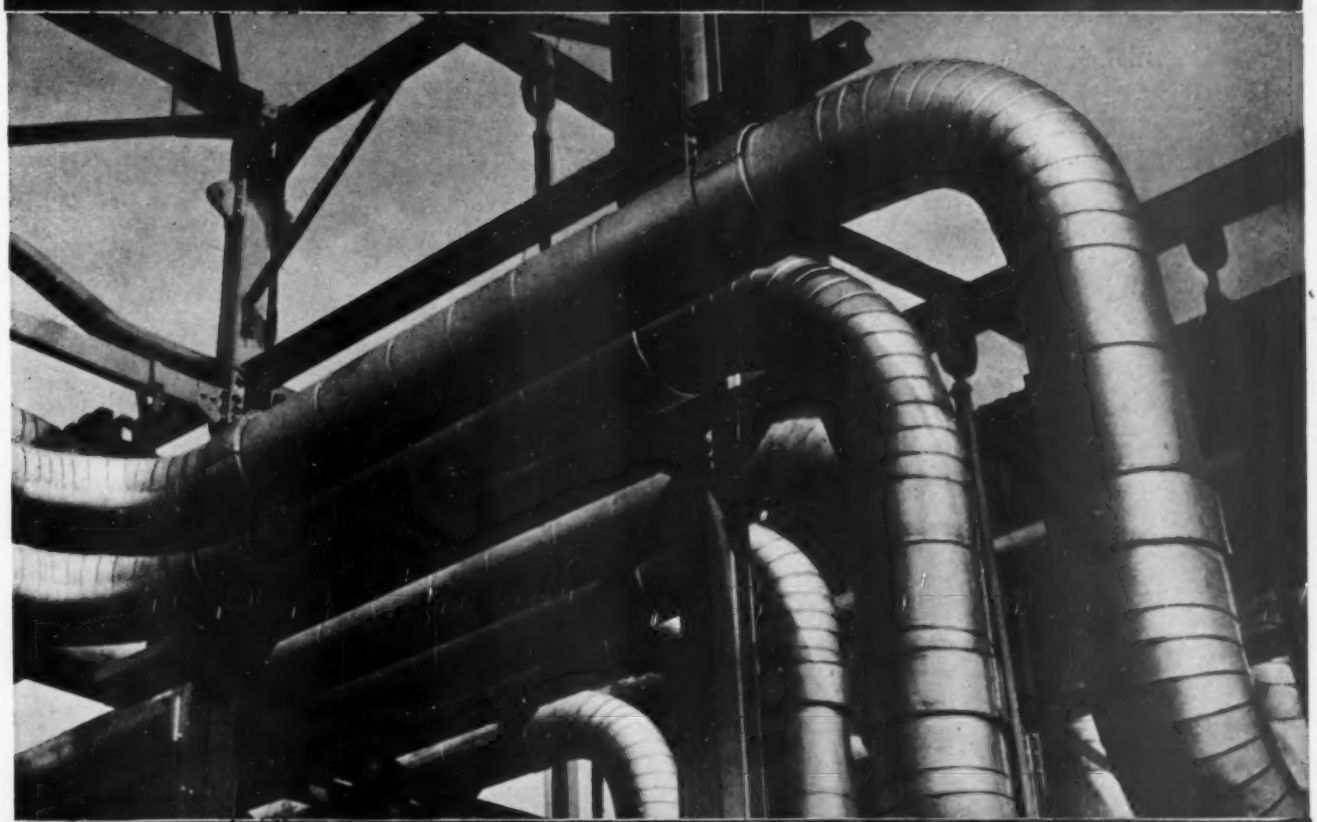

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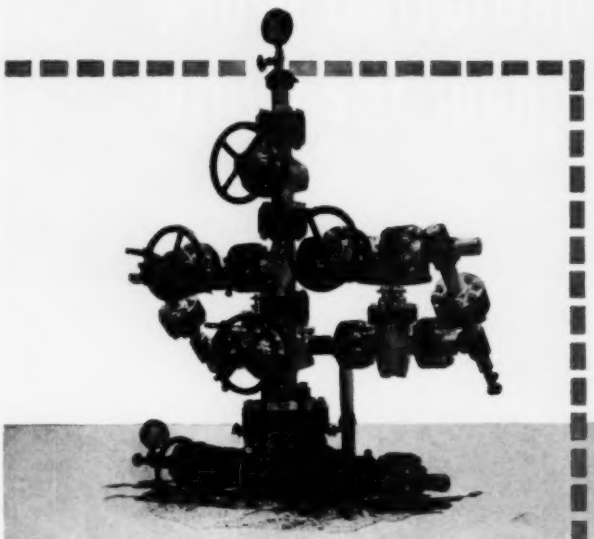

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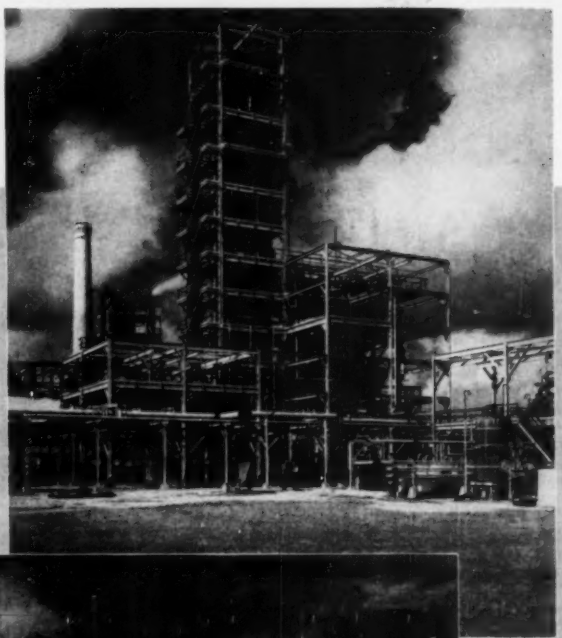

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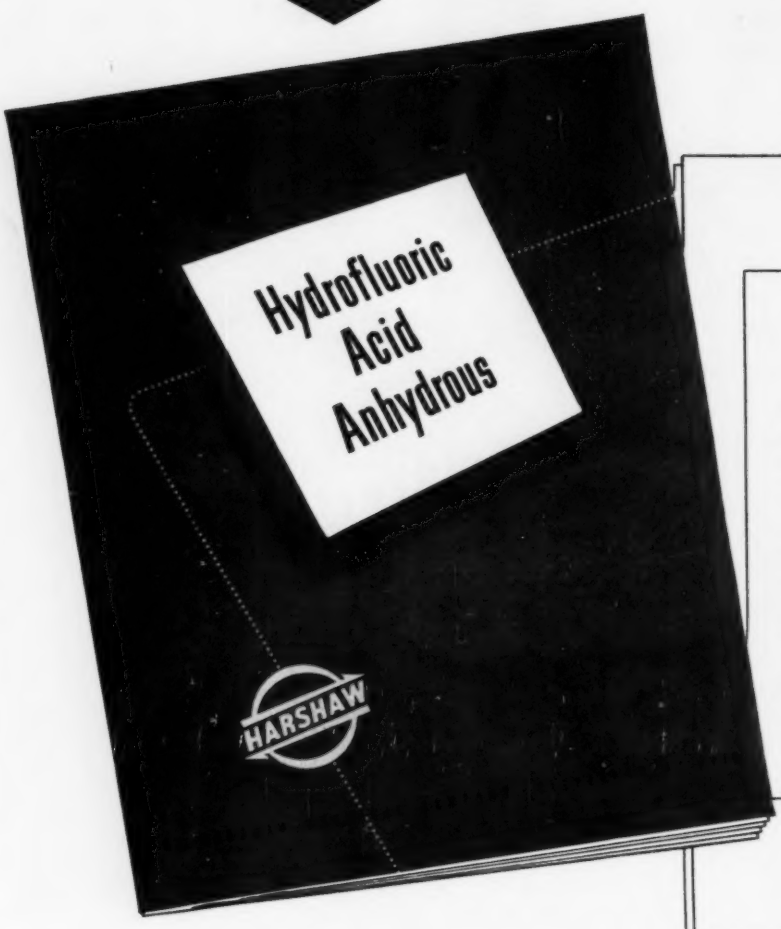


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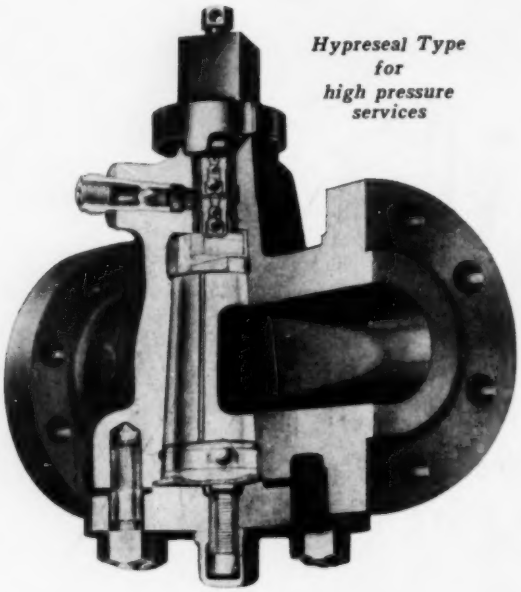

*Hypreseal Type for high pressure services*

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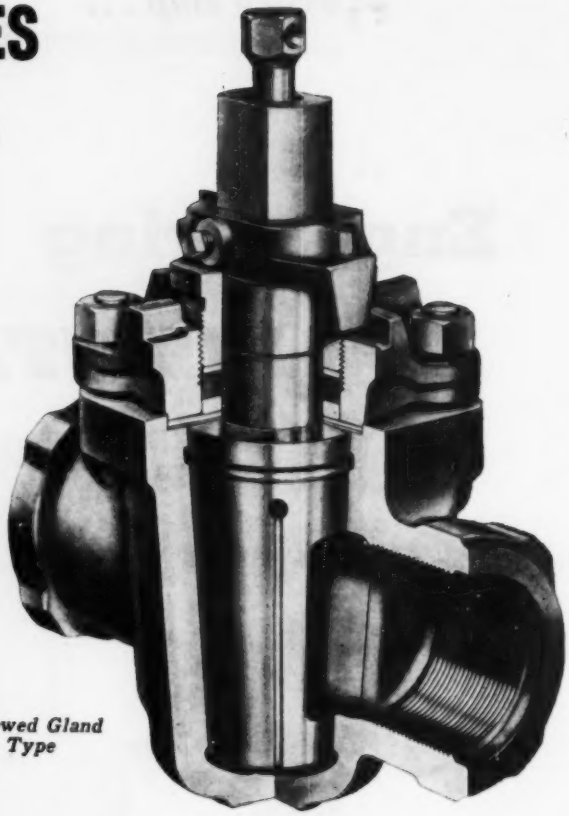

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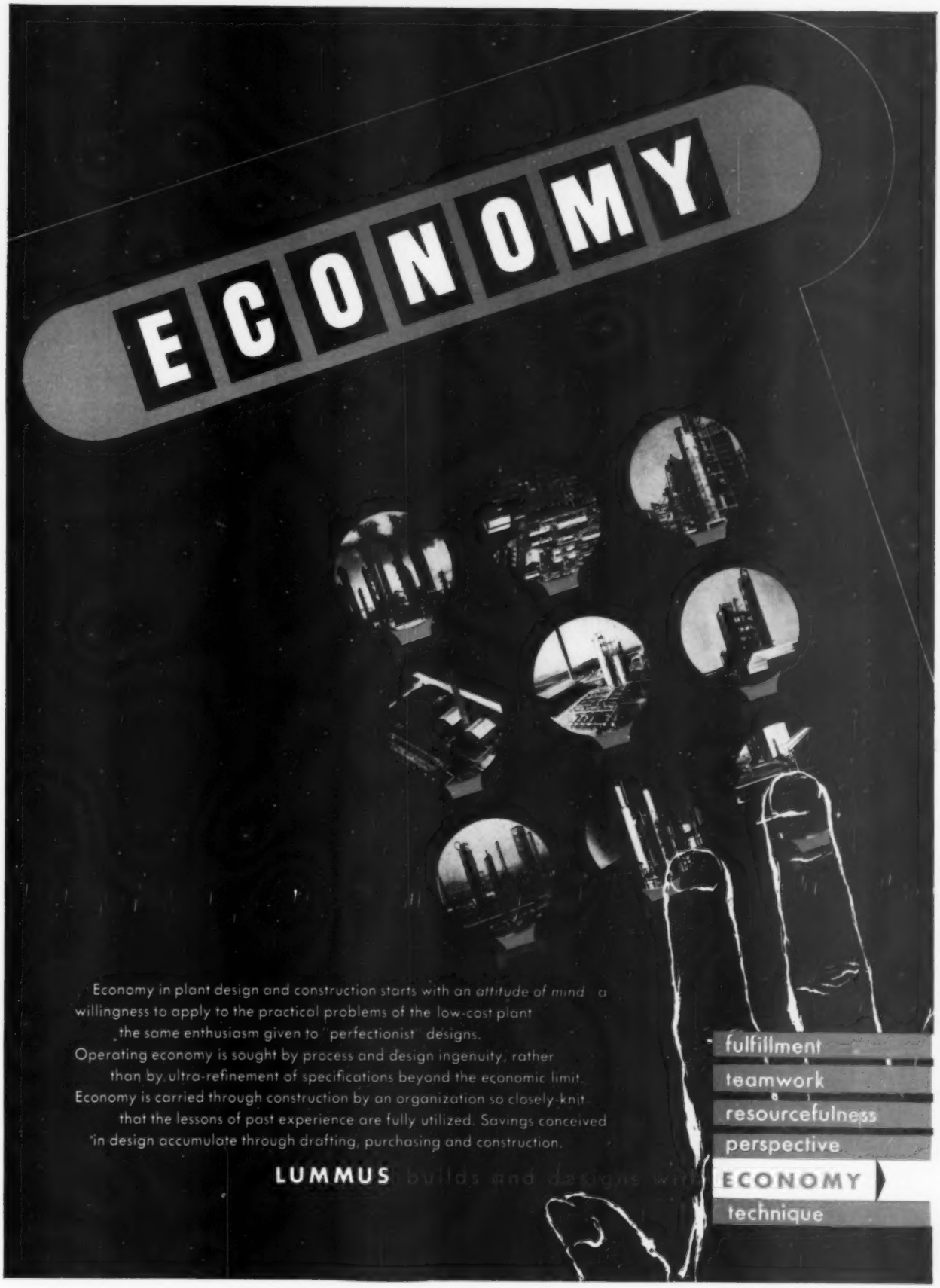
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*Founded by Russell Palmer*

PUBLISHED BY MONA PALMER

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY



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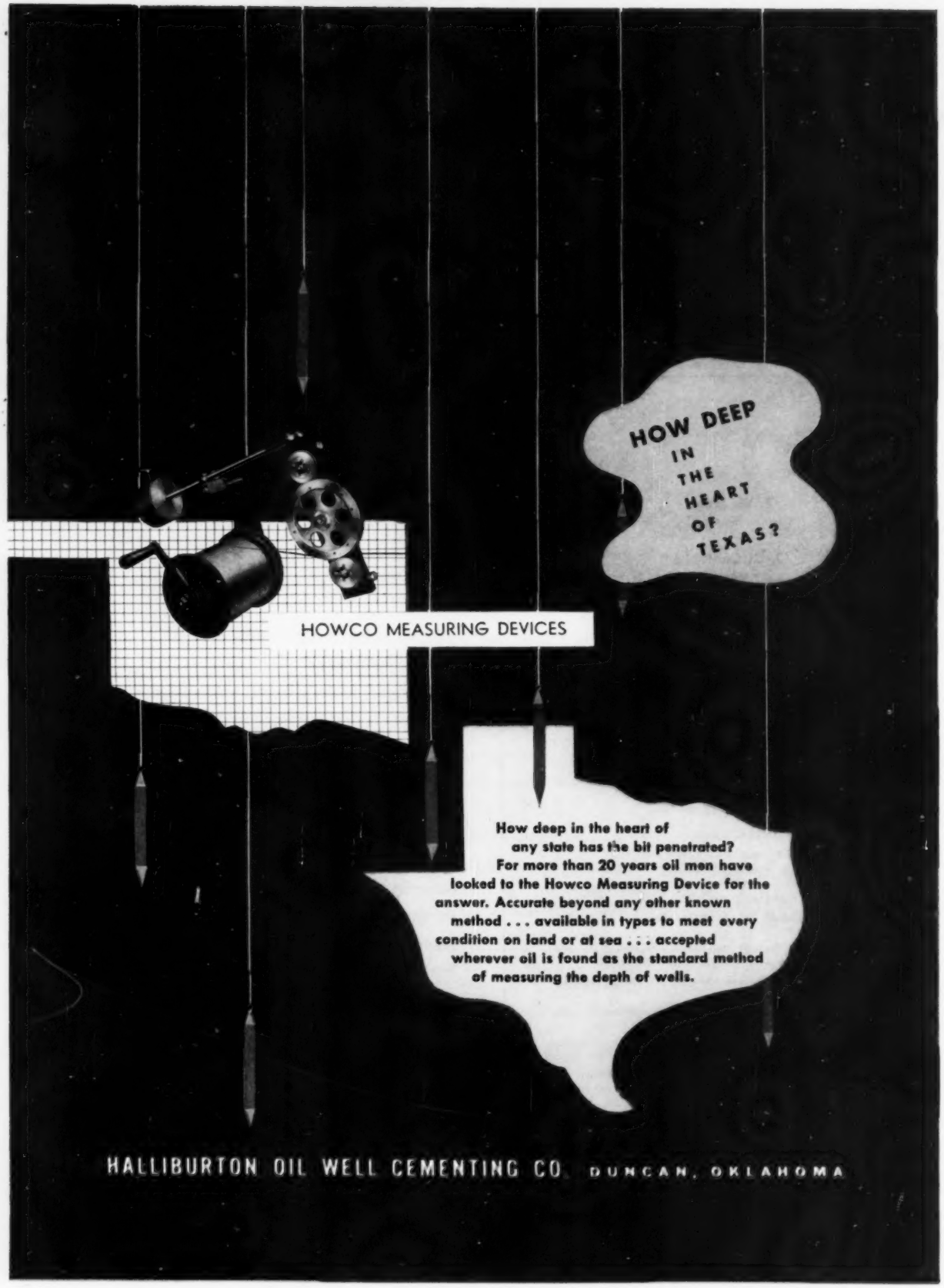
### THIS MONTH'S COVER

Two oil paintings by Frank Wootton are reproduced on this month's cover through the courtesy of Anglo-Iranian Oil Co. Ltd. The paintings depict shipping activity at Abadan, one of the great oil ports of the world. From the Anglo-Iranian refinery at Abadan an average of more than 400,000 barrels of petroleum products are sent to the markets of the world each day. Most of Anglo-Iranian's crude as such is loaded at a nearby port, as is explained in an article on page 48 of this issue, which describes a new addition to the company's pipeline system.

In the Anglo-Iranian (British Tanker Co.) fleet today are 121 tankers with a deadweight tonnage of 1,420,000, and this fleet is in process of being increased to 162 vessels of more than two million tons. Although the company lost nearly half its fleet by enemy action during the war, the losses have been more than made good by purchases and new launchings since VE Day. The company will take delivery on 15 new tankers this year and 22 next year.


HOW DEEP IN THE HEART OF TEXAS?
HOWCO MEASURING DEVICES
How deep in the heart of any state has the bit penetrated? For more than 20 years oil men have looked to the Howco Measuring Device for the answer. Accurate beyond any other known method . . . available in types to meet every condition on land or at sea . . . accepted wherever oil is found as the standard method of measuring the depth of wells.
HALLIBURTON OIL WELL CEMENTING CO. DUNCAN, OKLAHOMA

# EDITORIAL

## TAXATION'S GROWTH THREATENS ECONOMY

IN the internal economy of the United States one of the problems assuming threatening proportions is that of the constantly growing burden of taxation. Influenced perhaps by the example of the federal administration, the budgets of state, county and municipal authorities are becoming more and more swollen as the army of tax eaters becomes larger and larger and governmental activities extend into new fields that involve expenditures that quickly rise to staggering proportions.

The effect of this malignant growth upon the economy of the nation is making itself felt at the present time in the slackening flow of investment capital to productive enterprise. Industrial progress obviously depends upon the steady provision of more capital goods to provide employment for a constantly growing number of potential producers. If the accumulation of savings is halted, the opportunities for useful employment are diminished and an excuse is provided for governmental intervention and ultimate control—the socialistic state.

The oil industry has good reason to know the possibilities of tax manipulation because from its early days it has been a shining mark for the devisers of new levies. Some patient statistician has computed that there are over two hundred special taxes applying to petroleum, its products and their uses. Whether the number is exact or approximate, oil undoubtedly can lay claim to the doubtful honor of being probably the most variously taxed industry in the country.

In 1948 these taxes reached an all-time high. State revenues from the gasoline tax alone amounted to $1,336,000,000. The federal tax of one and a half cents per gallon yielded just under half a billion. Federal excise taxes footed up to $736,000,000, and state license and product taxes added $692,000,000 more. These imposts aggregated over three and a quarter billion dollars added to the fuel bill of American motorists, and this, of course, is aside from other hundreds of millions extracted in other kinds of charges imposed in various forms.

This year, with 44 state legislatures in session, 56 bills proposing increases in gasoline taxes had been introduced in 29 states up to the middle of March. Most of these provide for advances of one to two cents in existing rates. A few make permanent taxes originally imposed as emergency measures. However, opposition to further advances has developed in several states and five legislatures have rejected proposals for higher taxes thus far. The average state tax at the end of last year was 4.80 cents per gallon. Adding to this the federal tax of 1.5 cents makes the tax charge on gasoline alone 6.30 cents, or, if the state tax is weighted according to consumption, 5.80 cents. The tax represents roughly 30 percent of the price paid by the consumer. Taxes in a number of states are now at a level where they just about equal the refinery cost of producing gasoline. The net result of this year's crop of bills will be to add some millions of dollars to the sums now being taken from the pockets of motorists, who of course share all other taxes.

Many states have taxes on fuel oil, lubricants and other petroleum products. Sales taxes are becoming almost universal, being levied both by states and by local subdivisions. In New York City the local sales tax is charged upon the price of gasoline plus the tax, presenting the spectacle of a tax upon a tax. Ten states are this year considering new or increased severance taxes upon oil and gas, ranging from two to five percent of gross value. In Colorado a pending bill would place a flat charge of 22½ cents per barrel on wells yielding more than 750 barrels per month of oil below 30 gravity and 25 cents on 30 gravity or above.

A form of taxation new to the industry has been proposed in Oklahoma and Texas in the shape of processing taxes. In Oklahoma a bill before the legislature would impose an additional cent a gallon on all oil produced or brought in from outside. Texas has under consideration a proposal to substitute for the present four-cent tax on sales a tax of one cent on all liquid condensates manufactured or sold within the state. Such processing taxes would be particularly serious for refiners as they could not be passed on to consumers. As has been forcefully pointed out by President McCollum of Continental Oil Company, the ultimate effect of processing taxes would be the removal of refineries and allied industries from the states imposing such laws. The loss would be far more than the gain.

A great variety of other taxes directly or indirectly affect the oil industry such as toll charges, licenses exacted from service stations under the chain store laws of a number of states, and the many special taxes levied upon commercial vehicles. The billions of dollars to which the yearly tax burden of the oil industry has grown are symptomatic of a development that is taking place throughout the country and that needs to be checked before it stifles our free economy.

# TRENDS IN TANKER DESIGN

By William B. Jupp

Manager, Marine Construction and Repair, Socony-Vacuum Oil Co. Inc.

*Photo by Robert L. Browning*

WITH the close of the war in 1945 the construction of tankers throughout the world practically ceased. This was due to the large surplus of war-built vessels caused by the speeded-up production of wartime years. It was not until late 1947 that the need for new tankers was recognized. This was indicated by change of conditions calling for increased speed and quick turnaround, which demanded changes in design and equipment.

Tanker design is a very complex problem. The naval architect must consider various grades of petroleum products and the loading and discharging which involves location of pumps and pump-rooms. Machinery weight and conditions must be studied to permit the carriage of largest amount of cargo. All this is designed to suit the owner's particular requirements of loading and discharging facilities in various ports.

Probably the most noticeable change has been from deadweights of 16,000 tons and horsepowers of 4,000 to 6,000 to tankers of deadweights ranging from 25,000 to 30,000 tons and horsepowers of 12,000 to 20,000. A few of these vessels are between 550 and 600 feet, and the larger ones are in excess of 625 feet in length. These figures reflect the tremendous progress in the last ten years. Tankers of deadweights less than those mentioned are only constructed for specialized limited service.

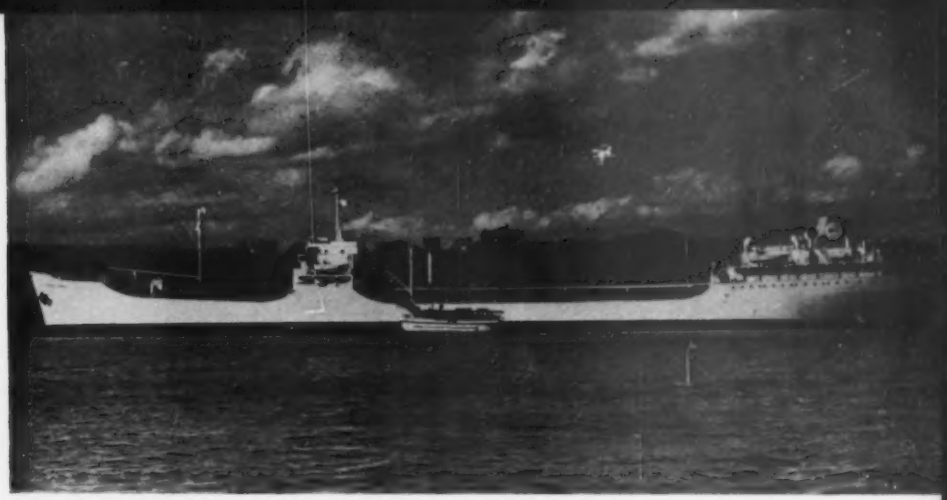
Present tanker construction reflects the knowledge gained during the war years. There has been a deviation from the all-welded type of construction to the use of some riveting in deck and hull plating to prevent propagation of cracks due to defective welding and to tanker designs not adapted to welding procedure. The use of

**Major Specifications of Currently Building Tankers**

| Shipyard | No. of Tankers | Deadweight | Length | Beam | Horsepower |
|---|---|---|---|---|---|
| **United States** | | | | | |
| Bethlehem-Sparrows Point Shipyard, Sparrows Point, Md. | 14 | 28,000 | 595' | 84' | 13,750 |
| Bethlehem Steel Co., Quincy, Mass. | 10 | 28,000 | 595' | 84' | 13,750 |
| Newport News SB & DD Co., Newport News, Va. | 11 | 26,000 | 600' | 82'6" | 13,750 |
| New York SB Corp., Camden, N. J. | 3 | 32,000 | 625' | 85' | 18,000 |
| Sun SB & DD Co., Chester, Pa. | 13 | 26,000 | 600' | 82'6" | 13,750 |
| Welding Shipyard, Inc., Norfolk, Va. | 5 | 30,000 | 615' | 84' | 17,600 |
| **Foreign** | | | | | |
| Furness SB Co. | 7 | 24,500 | 560' | 80' | 6,800 |
| " " " | 1 | 27,000 | 630' | 78' | 6,800 |
| Harland & Wolff | 1 | 24,500 | | | |
| " " " | 1 | 24,400 | 580' | 78' | 7,500 |
| " " " | 2 | 24,000 | | | |
| " " " | 1 | 28,000 | 610' | 80'6" | 11,000 |
| Swan, Hunter & Richardson | 1 | 26,000 | 590' | 80' | 7,200 |
| " " " " | 1 | 28,000 | 610' | 80'6" | 11,000 |
| Sir James Laing & Sons | 1 | 22,850 | 565' | 75' | 6,800 |
| " " " " " | 1 | 23,000 | 565' | 75' | 6,800 |
| Kockums Mek. Verk. | 4 | 24,400 | 570' | 77' | 7,000 |
| Eriksbergs Mek. Verk. | 2 | 24,400 | 570' | 70' | 7,000 |
| Gotaverken | 3 | 23,000 | 560' | 74'6" | 8,200 |
| John Crown & Sons | 1 | 23,000 | 565' | 75' | 6,800 |
| Vickers Armstrong | 1 | 24,500 | 560' | 80' | 6,800 |
| Cammell, Laird & Co. | 1 | 28,600 | 610' | 80'6" | 11,000 |

William Bradford Jupp, manager of the marine construction and repair division of the Socony-Vacuum Oil Company Inc., started with Socony-Vacuum on March 1, 1935, as assistant manager of the division and was advanced to his present position on January 1, 1946. He is a graduate of the United States Naval Academy, class of 1913, and retired as a lieutenant commander in the Navy before starting with Socony-Vacuum.

Mr. Jupp is chairman of the metropolitan section of the Society of Naval Architects and Marine Engineers and serves on technical committees of the American Bureau of Shipping, American Merchant Marine Institute, American Petroleum Institute and the National Fire Protection Association. In addition he is a member of the Propeller Club, Whitehall Club, New York Yacht Club, Merchant Marine Post of the American Legion and the Naval Academy Association of New York.



Yacht-like appearance of the S.S. Olympic Games is typical of the streamlined appearance of modern tankers. She is an 18,000-ton vessel with a speed of 15 knots and a cargo capacity of 152,200 barrels. Photo Courtesy Bethlehem Steel Co.

fluted bulkheads has continued in some of the postwar construction; others have reverted to the usual conventional flat plate and stiffeners.

Speeds in the present days have shown a sharp increase. The change since the turn of the century has been at an approximate rate of about one knot every ten years. Since 1940 the economical speed has increased at least two knots, and the large tankers now building or recently delivered are powered for sea speeds of 15 knots or more.

In American tankers the power plant follows closely the turbine reduction gear design used extensively during the latter war years. The engine room has not changed materially except for the present tendency to reduce the size of the generator flat and to drive cargo pumps by steam turbine rather than electric motor. Cargo pumping plants have been redesigned to discharge the ship's cargo in ten to twelve hours. Quick turnaround of tankers is an important item of today's petroleum commerce.

Modern advancement requires the use of automatic evaporators. This will permit the modern tanker to show an economy on long hauls by the increase in cargo deadweight, which is a very real value. The use of these evaporators reduces the normal water carried and increases the earning power of the vessel. When a long haul from the Near East is considered, this is a most important phase of petroleum operation.

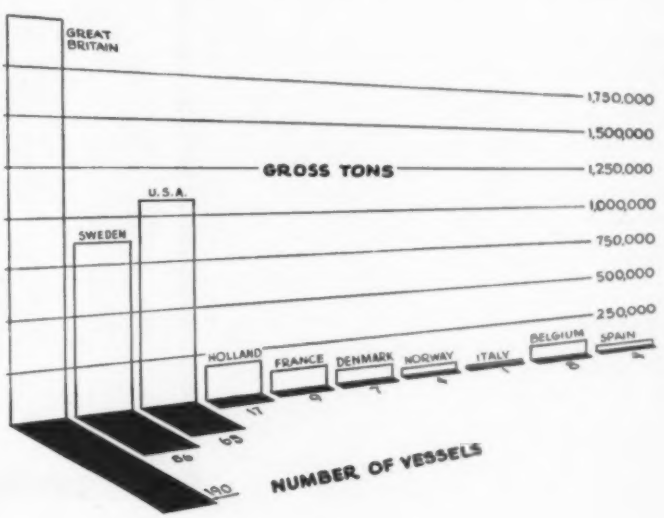
Perhaps these design changes toward more speed, larger deadweights and quicker turnaround are predicated on economy of service for use of tankers in the Near East trade. With the oil production shifting to that area, transportation of petroleum has become a revised problem in which transportation costs become a greater percentage of the delivery cost. This trend has been recognized by all industries in general and is particularly evidenced by the fact that the Suez Canal authorities have inaugurated a program of several years' duration, which will be started shortly, whereby the entire length of the Canal will be deepened sufficiently to accommodate ships with a draft up to 36 feet. The docks at Port Said will also undergo a program of enlargement. Other canal improvements are contemplated. Further, various harbor authorities are making studies of their facilities to enable these larger vessels to be accommodated.

Other technical improvements are being incorporated in present designs; each of which is a subject unto itself. The prevention of corrosion in cargo spaces is not the least of these. The latest safety devices are being installed. Radar is becoming practically standard equipment. Air conditioning is another improvement being installed in some of the tankers now being built, particularly those scheduled for operation and trading in the tropics. In some instances the crew's accommodations, as well as messrooms and recreation rooms, are being conditioned. Particularly striking are the improvements being made for the comfort of the crew. These consist of more spacious accommodations with privacy, lounge rooms, recreation rooms, toilet facilities and radio connections in each room. The more spacious accommodations are being furnished in some tankers to an extent which is amazing for this class of vessel.

Changes seem not so radical from an outside view. Most designs follow the three-island type of construction, but improvements can be noticed by the practiced eye. The absence of masts is a most evident change. Modernization has called for streamlining which gives a more attractive appearance. This can be noticed by the illustration of the "Olympic Games," recently delivered to the Olympic Oil Lines and built at the Bethlehem Steel Company's Sparrows Point Shipyard.

A review of available statistical data in the accompanying table gives representative comparison of large tankers building or on order in the United States and European shipyards.

Number of vessels and gross tonnage of oil tankers under construction in shipyards of the world.



# WORLD SHIPYARDS BUILDING LARGER AND FASTER TANKERS FOR LONGER SEA VOYAGES

THE world tanker shortage which retarded the free flow of oil in the early part of last year was corrected with the same dramatic suddenness which marked the industry's change from a shortage to a surplus of petroleum products. From active bidding for tankers on the part of shippers at premiums over normal rates, the situation was reversed in a short period. Tanker owners were seeking cargoes at rates down to and below normal, and a considerable number of ships were laid up from time to time for want of charters. It appears that the postwar shortage is definitely over, barring emergencies, and that relatively normal conditions are returning.

Actual deadweight tonnage of tankers did not change materially in 1948, and in fact there has been an increase of only about one percent in tanker capacity since the close of the war. As compared with prewar the world tanker capacity is, of course, very greatly expanded but only about in line with the increase in demand for petroleum.

The more comfortable tanker availability situation this year is primarily due to the dispersal by the United States government of the large fleet which had been built up during the war. On Sept. 30, 1947, the government held 193 tankers in the U. S. Maritime Commission reserve fleet. Of these 168 were built during the war and only 25 built before Sept. 3, 1939. By the end of the year this reserve fleet was down to 104 ships, and this number was reduced to 26 by midyear 1948. Of the 593 tankers flying the United States flag on January 1, 1949, there were 476 in private service with a deadweight tonnage of 7,199,300 and 117 in government service or reserve with a tonnage of 1,816,900.

During the period of the most acute shortage early in 1948, tankers were chartered at prices ranging as high as 230 percent premium over the U. S. Maritime Commission controlled rates. First quarter average for single voyage fixtures from the U. S. Gulf to North Atlantic U. S. ports was about $6.20 per ton on clean ships and $6.45 on dirty ships. During this period the controlled rate was $2.85 per ton on both classes of vessels.

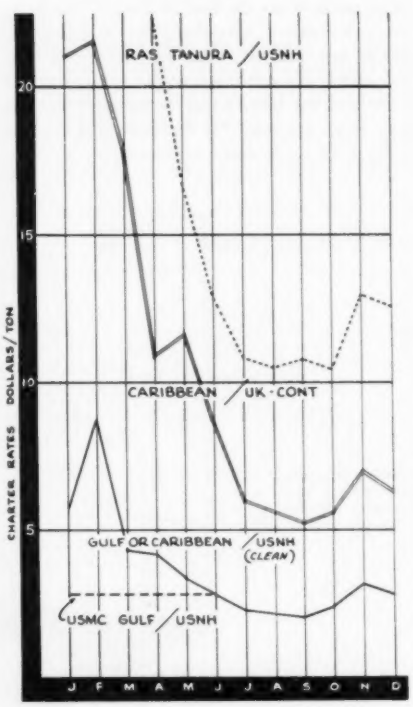
Release of the government ships to private industry brought fixtures down to a premium of only about 25 percent over controlled rates in the second quarter. Average clean boat charter rate was about $3.50 and dirty boat rate $3.60 in the second quarter. In the third quarter the rate continued to sag and dropped about 20 percent under the former controlled rate which expired on June 30. In the final quarter rates were about on the level of the U. S. Maritime Commission control figure.

Single voyage fixtures from Caribbean ports to the United Kingdom and the European continent started the year 1948 at about $21 per ton and by the end of the year were down to less than a third as much, averaging $6.29 in December. First quarter 1949 rates were as low as $5.75.

From the Persian Gulf to North Atlantic ports rates were as low as $10.16 in the middle of 1948. At the year end these were up about 25 percent to $12.62, just below the old controlled rate of $12.70. Current charters in this service also are lower today. The general going rate in most areas is about 15 percent below USMC on dirty ships and five percent below USMC on clean ships.

Late in the year the shortage of dollars brought about a differential in the level of rates between sterling and dollar areas. An accompanying chart shows the changes in tanker rates in 1948 as reflected by a tabulation prepared by Dietze, Inc., New York ship brokers.

Trend of tanker charter rates in 1948.




Now that the United States government has sold its war surplus fleet so that there is no further cushion in sight, it becomes necessary for the world shipbuilding industry to supply enough new vessels to provide for expansion in trade and to replace obsolete equipment. The industry received a large number of new orders during the past year and now has enough business in sight to keep busy for several years. Sun Shipbuilding and Dry Dock Co., for example, now has a backlog of orders for 15 supertankers.

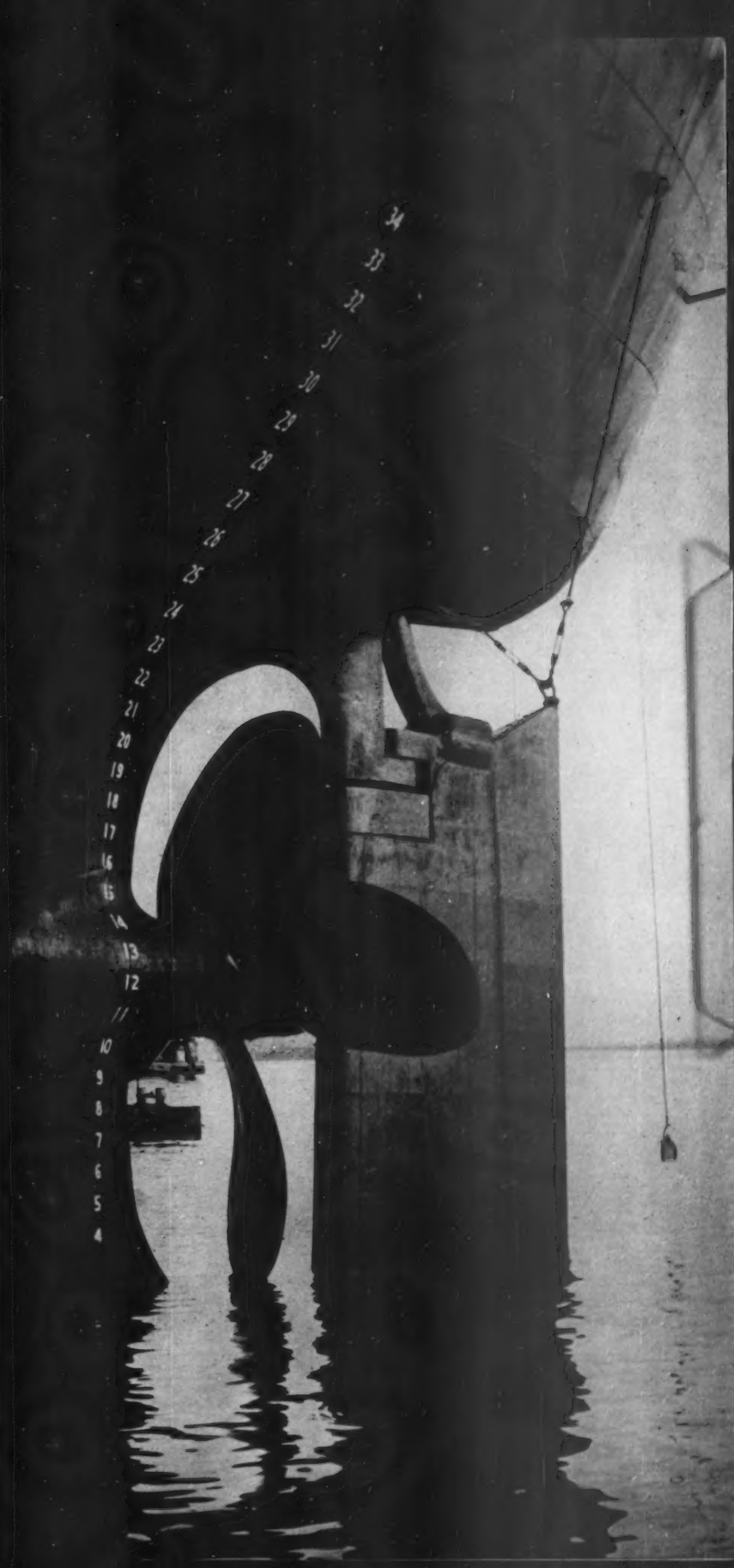
In 1947 world construction of tankers totaled 31, of which 30 were delivered by yards outside the United States. In 1948 deliveries rose to 50, but, as indicated previously, scrapping of old ships was at a rate which prevented any material increase in the fleet. The number of ships actually decreased, although the tonnage was higher by about 212,000 tons.

The Shipbuilders Council of America reports that 391 tankers of 1,000 gross tons or larger were on order on Jan. 1, 1949, in the world's shipyards. Total tonnage on order is 4,429,517 which is 55 percent of the total tonnage of all classes of merchant shipbuilding on order throughout the world. The accompanying table shows that almost half of the total number of ships are being built by British yards. The size of these ships is a little less than the world average, with the result that British yards have on order 44.5 percent of the total world tonnage. United States yards with 17 percent of the number of ships accounts for 24.6 percent of the tonnage. The 65 ships ordered from United States yards will have a total gross tonnage of 1,089,000, an average of 16,800 tons. Swedish yards with orders for 86 tankers with a total of 862,220 tons are building ships averaging 10,000 gross tons each. World average of ships on order is 11,409 gross tons.

Following his recent address before the Merchant Marine Conference, M. G. Gamble, general manager of the marine department of Standard Oil Co. (N. J.) stated that growth of the oil industry requires a net addition to the world tanker fleet of about three percent annually and that obsolescence of the existing fleet requires replacement of about five percent annually. This means that the world's shipyards now have business in sight of about 1,700,000 deadweight tons per year for the future. On the basis of T-2 equivalents the current annual demand is for about 100 tankers, which closely approximates the present building level.

Benedict Saurino, manager of Sun Oil Com-

The propeller of the Esso Zurich, new 26,000 ton supertanker has a diameter of 21 feet. Photos on this page by Webb for Standard Oil Co. (N.J.)

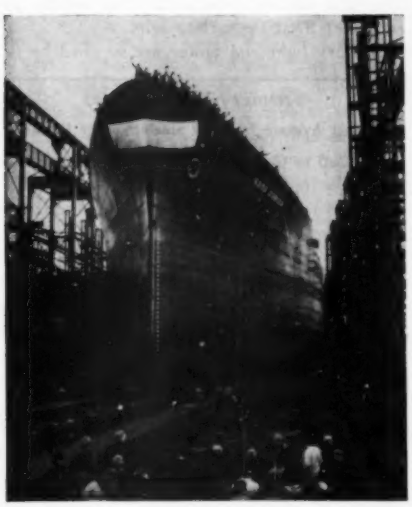


pany's statistical research division, has estimated that world shipyards will deliver 440 tankers between Sept. 1, 1948, and Dec. 31, 1952. These ships will have a deadweight tonnage of 7,453,-080 and a T-2 equivalent of 435.8 ships. With no allowance for scrapping of vessels more than 20 years old, this would bring the world feet to 2,311 tankers with a deadweight tonnage of 31,-238,880 and a T-2 equivalent of 1,708.2 tankers With full allowance for scrapping of obsolete tankers the fleet would consist of 1,744 ships at the end of 1952 with a deadweight tonnage of 25,726,580 and a T-2 equivalent of 1,468.6 ships. The actual figure doubtless will fall between the two since scrapping does not always follow a 20-year pattern. At present 8.1 percent of the world's capacity is at least 26 years old.

It would be convenient if tanker owners could plan a 20-year replacement period and systematically scrap five percent each year. Unfortunately wars have a habit of intervening in recent generations with the result that great building peaks have been built up in wartime. More than half of the present world tanker fleet was built in the three years 1943-1945 to replace wartime sinkings and to provide for servicing military operations in Europe and the Orient. The Norwegian fleet has a more-or-less normal age pattern, and no other national fleet of consequence has fluctuated quite so violently as that of the United States. For the near term United States owners have a considerable number of tankers still in service which were built during World War I and which will be replaced with newer and faster ships in addition to the number which must be built to keep pace with the growth of trade.

On the basis of carrying capacity Mr. Saurino has estimated that with full scrapping the privately owned world fleet will be able to carry 15

The Esso Zurich, first of 14 supertankers to be launched for Standard Oil Co. (N.J.) from ways of Sun Shipbuilding and Dry Dock Co., Chester, Pa.



Discharging cargo. Photo by Libsohn for Standard Oil Co. (N.J.)

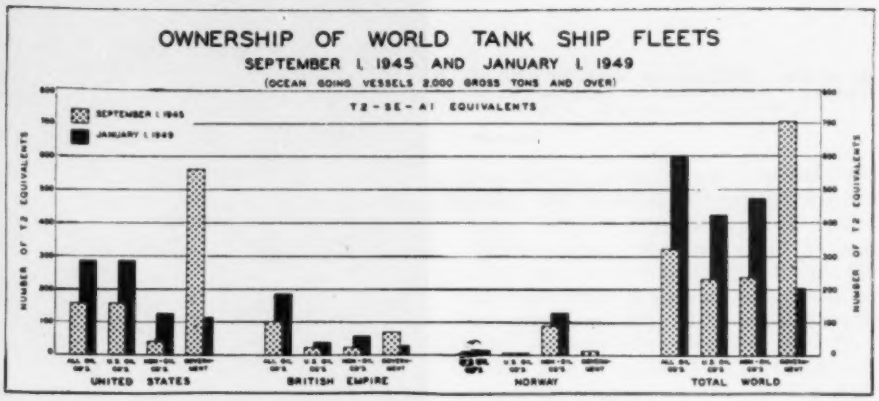

OWNERSHIP OF WORLD TANK SHIP FLEETS
SEPTEMBER 1, 1945 AND JANUARY 1, 1949
(OCEAN GOING VESSELS 2,000 GROSS TONS AND OVER)
T2 - SE - A1 EQUIVALENTS
SEPTEMBER 1 1945
JANUARY 1 1949
NUMBER OF T2 EQUIVALENTS
UNITED STATES
BRITISH EMPIRE
NORWAY
TOTAL WORLD

Chart courtesy Sun Oil Co. statistical research division.

percent more oil at the end of 1952 than in 1948. With no scrapping the carrying capacity would rise 37 percent. Regulation of scrapping thus will give the industry a great deal of flexibility to take care of changes in length of ocean haul and growth in trade. This flexibility will help in caring for changes in shipping load which may be brought about by deviations from present schedules in the construction of pipelines across Arabia and from Iraq to the Mediterranean. While the steel situation seems to be clearing to the point where it will not be a bottleneck in pipeline construction, the political situation is not quite so clear.

New postwar ships are faster as well as larger than prewar. Of the 1,872 tankers in the world fleet on Jan. 1, the speed of 701 was 14 knots or higher. Of these 561 had a speed range of 14 to 14.9 knots; 70 from 15 to 15.9; 35 from 16 to 16.9 and 35 from 17 to 19.9 knots. The new supertankers fall in the 16 to 16.9 knot range.

In 1948, of the six tankers delivered by United States yards, four were turbine-driven and two diesel-driven. The diesel-driven ships had an aggregate horsepower of 2,800 compared with 35,750 for the four turbine-driven tankers. The American Bureau of Shipping current report of ships on order and under construction indicates that all are to be turbine-driven.

M.S. Explorador after launching at the Belfast yards of Harland & Wolff, Ltd., on Feb. 15. She is a 9,000-ton tanker built for Cia Estrella Maratima, S.A., an Argentine Shell company.

General Electric Co. announced that marine propulsion turbines and gears powered the new supertanker "Esso Zurich" on her recent trial run. The vessel, first of a fleet of 14 high-speed tankers for Standard Oil Co. (N. J.), made her maiden voyage recently in ballast from Chester, Pa., to Corpus Christi, Texas, and returned with crude oil to Bayway, N. Y.

The ship, first 26,555 deadweight supertanker to be delivered to its owners, was built by Sun Shipbuilding and Dry Dock Co., at Chester, Pa. Designed to cruise at 16 knots, the "Esso Zurich" made in excess of 17 knots over a measured course in Refuge Bay near the entrance to the Delaware River. Propulsion equipment on the tanker consists of one high-pressure and one low-pressure turbine, combined to form one cross-compound unit generating 12,500 horsepower under normal conditions. Maximum shaft horsepower is 13,750. Steam conditions are 835 psig and 840°F. at the turbine inlet.

Auxiliary light and power are supplied by two

## Summary 1948 Fixtures

Actual Average Monthly Single Voyage Fixtures
(Dollars per Ton)
U. S. Gulf or Caribbean—U. S. North Atlantic Ports

| Month | Clean | Dirty |
|---|---|---|
| January | $5.70 | $7.12 |
| February | 8.55 | 7.96 |
| March | 4.33 | 4.33 |
| April | 4.27 | 4.27 |
| May | 3.36 | 3.84 |
| June | None | 2.78 |
| July | 2.28 | 2.24 |
| August | None | 2.27 |
| September | 2.14 | 2.19 |
| October | 2.48 | 2.49 |
| November | 3.19 | 2.93 |
| December | 2.80 | 2.66 |
| Average 1948 | $3.95 | $3.31 |

*Table prepared by Dietze, Inc., oil and ship brokers and ship chartering agents, New York, N. Y.

**World Tanker Building—January 1949**

New Construction in Hand or on Order
(1,000 Gross Tons and Over)

| Country | Number | Gross Tons | Percent of Total Tonnage |
|---|---|---|---|
| Great Britain | 190 | 1,977,460 | 44.7 |
| Sweden | 86 | 862,220 | 19.4 |
| United States | 65 | 1,089,000 | 24.6 |
| Holland | 17 | 168,236 | 3.8 |
| France | 9 | 106,642 | 2.4 |
| Denmark | 7 | 66,499 | 1.5 |
| Norway | 4 | 42,000 | 1.0 |
| Italy | 1 | 2,000 | — |
| Belgium | 8 | 85,609 | 1.9 |
| Spain | 4 | 29,851 | 0.7 |
| Total | 391 | 4,429,517 | 100.0 |

Source: Shipbuilders Council of America

GE 400-kw turbine-generator sets, designed particularly for use on this class of ship. The six-stage turbines operate off the main boilers under the same steam conditions as the main propulsion turbines.

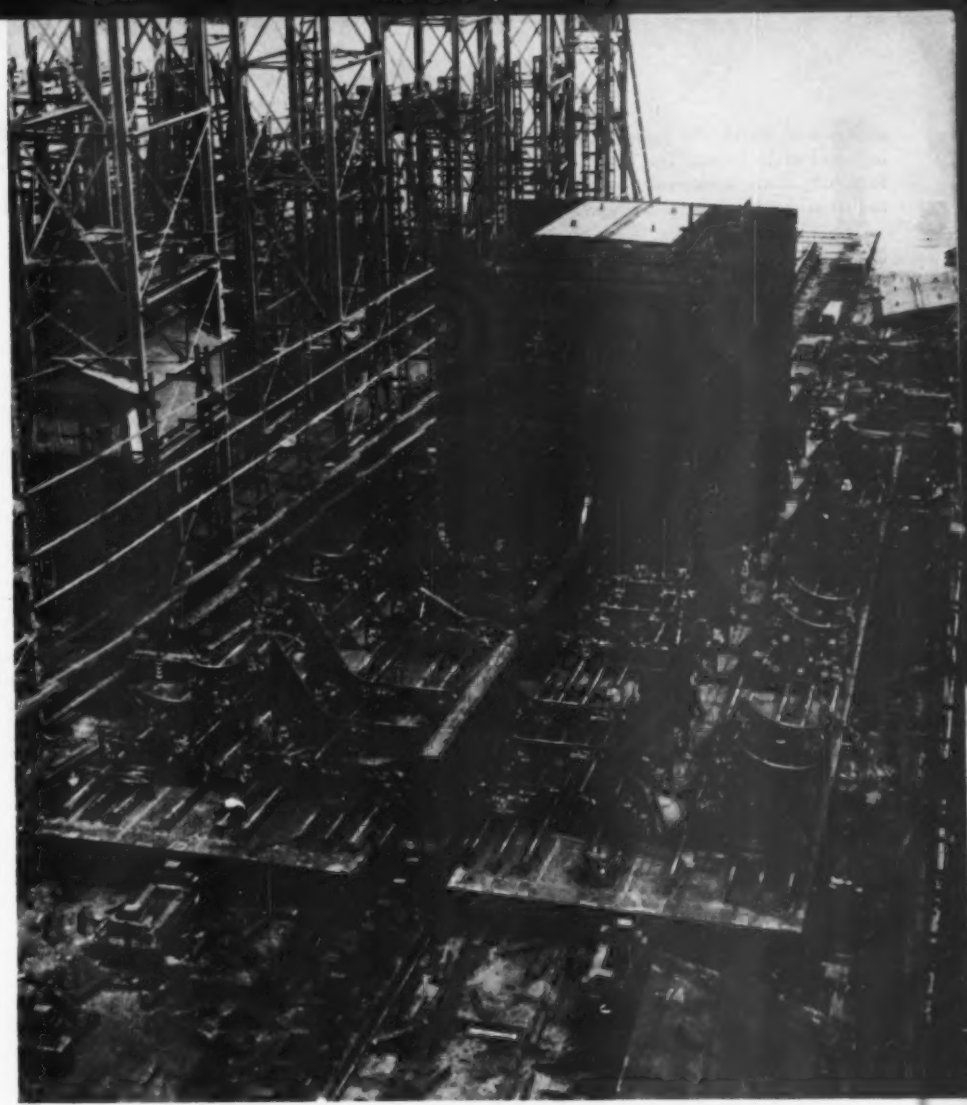
The a-c generators are six-pole, three-phase, 60-cycle, 450-volt units that operate at 1200 rpm. They are capable of carrying a 25 percent overload for a two-hour period when operating at rated steam conditions.

The next tanker in this class to go into service will be the "Esso Suez," also owned by Standard Oil Co. (N. J.) This vessel was launched Jan. 14 at the yard of the Newport News Shipbuilding and Dry Dock Co. Main and auxiliary power units for the "Esso Suez" have also been supplied by General Electric.

Other supertankers are being built for The Texas Co., Gulf Oil Corp., Standard Oil Co. of California, Shell interests and others. Of the 55 tankers on the ways or on order in the United States on February 1, 1949, there were 25 with a deadweight tonnage of 28,000 or more and 24 of 26,000 deadweight tonns. Three will have a tonnage of 30,000 and three a tonnage of 32,000. Largest tanker now afloat is the 30,000 ton "Bulkpetrol" which will be joined by three other sister ships in the next few years from the Welding Shipyards, Inc., Norfolk, Va. The "Bulkpetrol" arrived at Shell Haven, England, Dec. 1, 1948, on the conclusion of her maiden voyage from Aruba.

Built for Oceanic Tankships S.A., of Panama, this vessel, which is on a five year time charter to The Anglo-Saxon Petroleum Co., is of all-welded construction and has a number of unusual features. Of these the most noticeable is, perhaps, the siting of the midships superstructure, which is much further aft than is normally the case with tankers, as out of a total length of 630 feet, 360 feet are forward of the navigation bridge.

Another innovation is the abolition of the catwalk or flying bridge on the foredeck. This gives the vessel a very neat appearance forward and an air of modernity which is further heightened by the streamlining effect of the navigation bridge. "Bulkpetrol" is equipped with engines capable of developing 26,000 horsepower, although only approximately half this power was



Midsection of the Esso Zurich on the ways of Sun Shipbuilding and Dry Dock Co., Chester, Pa.

The Houston ship channel between Galveston and Houston is the source of a vast amount of petroleum shipping. Photo by Robert L. Browning, Texas City.

employed on the maiden voyage to give a cruising speed of 16 knots. The layout and general furnishing of the accommodation is very similar to that of the American T-2 tankers.

Manned by United States officers and a West Indian crew, "Bulkpetrol" flys the Panamanian flag and, together with a sister ship now under construction which will also be time-chartered by The Anglo-Saxon Petroleum Co., will mainly be engaged in transporting crude oil from the Persian Gulf to the Shell Group's refineries in Great Britain and at Pernis, Holland.

Canada's first 26,000-ton supertanker will join the Imperial Oil Shipping Co. fleet in May. She is being built by Sun Shipbuilding and Dry Dock Co., at Chester, Pa., and will be christened the "Imperial Alberta." She will go into the Persian Gulf trade bringing Middle East crude to the Portland, Me., terminus of the Montreal-Portland pipeline.

General Electric double-reduction turbines will develop 12,500 horsepower and drive a single screw.

Rapid progress is being made on many of the new tankers. The SS "Olympic Games" recently was launched at Bethlehem's Sparrows Point yards after only 227 days. This is an 18,000-ton ship powered with Foster Wheeler boilers and with geared turbines.

On March 15 the same shipbuilder launched the first of The Texas Company's supertankers "The Pennsylvania," at Quincy, Mass., 225 days after the keel was laid. This is a 28,000-ton vessel with a cargo capacity of 240,000 barrels plus 65,600 cubic feet of dry cargo space. With Foster Wheeler boilers, Bethlehem turbines and Falk main gears, the ship has a normal rating of 12,500 hp at 100 rpm and a maximum power of 13,750 hp at 103 rpm. The high-pressure turbine turns at 4,700 rpm, and the low-pressure turbine at 2,630 rpm.

The "Imperial Alberta" will bring the shipping company's fleet to a total of 10 ocean ships and one coastal tanker. In addition, Imperial Oil's marine department operates 17 lake and coastal vessels.

Including the supertanker, eight new ships have been added to the ocean fleet and three to the lake fleet since World War II ended. During the war five of the lake ships were pressed into the hazardous coastal service but all escaped unscathed. The ocean fleet was not so fortunate. Four ships were lost through enemy action. Three others, worn out in arduous service, were scrapped after hostilities ended.

In England a 28,000 DWT tanker is to be built by Messrs. Swan, Hunter at Wallsend-on-Tyne. This is the second vessel of this tonnage now on order with the firm for the Shell fleet and brings the total number of 28,000-ton tankers to be built for Shell up to four. Two others are under construction by Harland and Wolff at Belfast and by Cammell, Laird at Birkenhead.

The newly ordered tanker, which is to cost more than one million pounds, is expected to be ready for service by the end of 1951, about six months after the sister ship now building in the same yard. She will be constructed to Shell marine department specifications which will include oil-firing, water-tube boilers and propulsion by geared turbines. Machinery to be installed in the new tanker will be supplied by the Wallsend Slipway and Engineering Co., a subsidiary of Swan, Hunter.

In the past month two oil tankers, each of 9,000 DWT, have been launched in British shipyards for service with the Cia. Estrella Maritima, S.A., an Argentine associate of the Royal Dutch-Shell Group. Built by Messrs. Harland and Wolff Ltd., at their Govan (the Clyde, Scotland) and Belfast (N. Ireland) yards, the motor vessels, named "Cazador" and "Explorador," will have accommodation for first and second class passengers, an unusual feature in oil-carrying vessels. Passenger accommodation has been incorporated

*(Continued on page 72)*

## Changes in World Tanker Fleet

| Nation | January 1, 1948 Number | January 1, 1948 DW Tonnage | January 1, 1949 Number | January 1, 1949 DW Tonnage |
|---|---|---|---|---|
| United States | 772 | 10,587,771 | 593 | 9,016,200 |
| British Empire | 482 | 5,139,131 | 472 | 5,424,300 |
| United Kingdom | 445 | | 477 | |
| Canada | 24 | | 22 | |
| Other | 13 | | 3 | |
| Argentina | 29 | 231,740 | 29 | 245,200 |
| Belgium | 5 | 59,931 | 5 | 58,500 |
| Brazil | 7 | 57,316 | 5 | 44,000 |
| China | 4 | 46,000 | 5 | 61,500 |
| Denmark | 11 | 149,561 | 15 | 201,100 |
| France | 44 | 502,620 | 51 | 698,500 |
| Greece | 5 | 39,501 | 11 | 149,100 |
| Italy | 43 | 435,716 | 62 | 745,400 |
| Japan | 12 | 74,122 | 7 | 85,900 |
| Mexico | 12 | 117,122 | 13 | 129,800 |
| Netherlands | 84 | 571,432 | 91 | 665,600 |
| Norway | 188 | 2,407,491 | 208 | 2,742,000 |
| Panama | 157 | 1,976,522 | 175 | 2,310,900 |
| Portugal | 6 | 45,728 | 6 | 59,100 |
| Spain | 21 | 178,705 | 21 | 176,600 |
| Sweden | 36 | 506,756 | 36 | 506,200 |
| Soviet Union | 24 | 219,432 | 19 | 175,900 |
| Venezuela | 24 | 98,072 | 28 | 116,700 |
| Others | 20 | 159,506 | 20 | 203,300 |
| Totals | 1,986 | 23,603,175 | 1,872 | 23,815,800 |

## Estimated World Tank Ship Fleet for Years Ending 1948 to 1952

*Tables Courtesy Sun Oil Co.*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 4 Mos., 1948 | 71 | 1,006,850 | 57.4 | 1,942 | 24,792,650 | 1,329.8 | 1,521 | 21,003,850 | 1,169.7 |
| 1949 | 174 | 2,869,480 | 169.0 | 2,045 | 26,655,280 | 1,441.4 | 1,592 | 22,528,180 | 1,266.2 |
| 1950 | 285 | 4,960,180 | 296.0 | 2,156 | 28,745,980 | 1,568.4 | 1,654 | 24,000,380 | 1,364.3 |
| 1951 | 393 | 6,707,380 | 394.7 | 2,264 | 30,493,180 | 1,667.1 | 1,713 | 25,166,480 | 1,436.3 |
| 1952 | 440 | 7,453,080 | 435.8 | 2,311 | 31,238,880 | 1,708.2 | 1,744 | 25,726,580 | 1,468.6 |

Intercoastal canal near Galveston, Texas. This canal carries crude and refined products from Texas fields and refineries to the Mississippi and its tributaries. Photo by Robert L. Browning.

# KNOWN RESERVES ROSE 8.3 PERCENT IN 1948

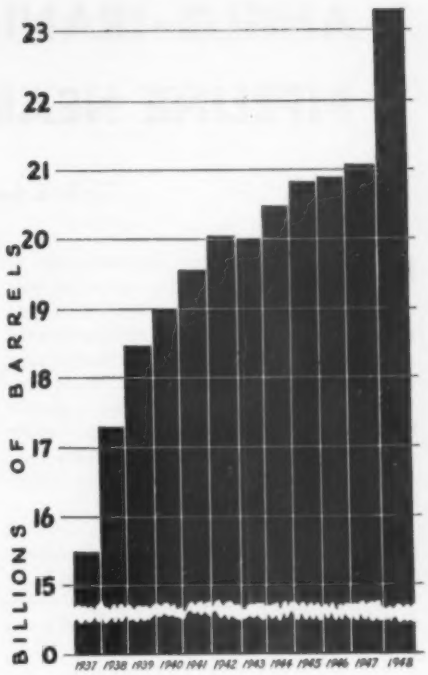
Known reserves of crude petroleum in the United States at the close of 1948 are reported by the American Petroleum Institute committee on reserves, of which F. H. Lahee of Sun Oil Company is chairman, as 23,280,444,000 barrels. This is a gain of 1,792,759,000 barrels or 8.3 percent over 1947. It represents the largest gain in known petroleum resources made in any year since 1938.

Additions to proved reserves from discoveries, additions and revisions amounted to 3,795,207,000 barrels in 1948. Withdrawals during the same period amounted to 2,002,448 barrels. Table I shows in detail the changes that have taken place during the year.

Largest gains in reserves were made by Texas, followed in order by California, Oklahoma, Kansas and Louisiana. These five states were responsible for 90 percent of the net increase. In several states withdrawals exceeded new supplies, but in most of these the changes were relatively small, the most noteworthy declines being in Colorado and Pennsylvania.

In accordance with a practice established in 1946 the API committee, through cooperation of a committee of the American Gas Association, has included with its report a computation of known reserves of natural gas. For 1948 this includes "stored gas," that is, gas that has been transferred from its original location to some other underground reservoir for purposes of conservation or for other future use. This makes possible a more complete inventory of all petroleum hydrocarbons.

Additions to known reserves of natural gas during 1948 amounted to 13,950,054 million cubic feet including an increase of 51,482 million cubic feet in storage. Withdrawals during the year were 6,007,628 million cubic feet, leaving a total of 173,869,340 million cubic feet, a gain of 7,942,426 or 4.8 percent over Dec. 31. 1947. Reserves of natural gas liquids increased 286,808,000 barrels during 1948 to a total of 3,540,783,000 barrels, bringing the total known reserves of liquid hydrocarbons up to 26,821,227,000, a gain of 2,079,567,000 or 8.4 percent as compared with December 1947.




Trend of United States Crude Reserves. →

**Table I**

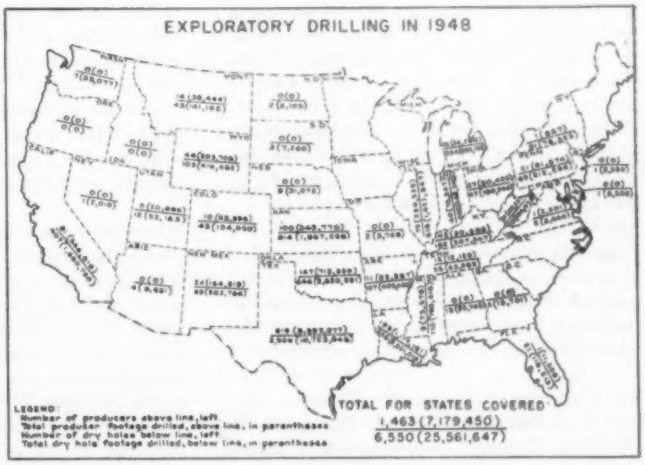
**Liquid Hydrocarbon Reserves**
**(Barrels of 42 U. S. Gallons)**

| | Crude Oil | Natural Gas Liquids | Total Liquid Hydrocarbons |
|---|---|---|---|
| Total proved reserves, Dec. 31, 1947 | 21,487,685,000 | 3,253,975,000 | 24,741,660,000 |
| Proved reserves added in 1948* | 3,795,207,000 | 470,557,000 | 4,265,764,000 |
| Total proved reserves Dec. 31, 1947, plus 1948 additions | 25,282,892,000 | 3,724,532,000 | 29,007,424,000 |
| Less production during 1948 | 2,002,448,000 | 183,749,000 | 2,186,197,000 |
| Total proved reserves, Dec. 31, 1948 | 23,280,444,000 | 3,540,783,000 | 26,821,227,000 |
| Increase in reserves during 1948 | 1,792,759,000 | 286,808,000 | 2,079,567,000 |
| *1948 Additions made up as follows: | | | |
| Revisions of previous estimates | 1,958,853,000 | 405,874,000 | 3,804,600,000 |
| Extensions of old pools | 1,439,873,000 | | |
| New pools discovered in 1948 | 396,481,000 | 64,683,000 | 461,164,000 |

# EXPLORATORY DRILLING IN 1948

ACCORDING to the annual report of Dr. F. H. Lahee, chairman of the committee on statistics of exploratory drilling*, 8,013 exploratory holes were drilled in the United States in 1948 with a total footage of 32,741,097 feet or an average of 4,068 feet. This compares with 6,775 exploratory drillings aggregating 26,393,348 feet or an average depth of 3,896 feet in 1947.

Of these exploratory wells 1,463 were producers and 6,550 were dry holes. Thus 18.3 percent of the holes drilled and 21.9 percent of the footage proved productive, an average of one successful well to every 4.50 dry holes. Of the holes drilled on technical advice, 13 percent were producers as compared with 3.1 percent of those drilled without such recommendation. Seismograph surveys were responsible for 219 producers and 948 dry holes among the new fields wildcats.


EXPLORATORY DRILLING IN 1948
LEGEND:
Number of producers above line, left.
Total producer footage drilled, above line, in parentheses
Number of dry holes below line, left.
Total dry hole footage drilled, below line, in parentheses
TOTAL FOR STATES COVERED
1,463 (7,179,450)
6,550 (25,561,647)

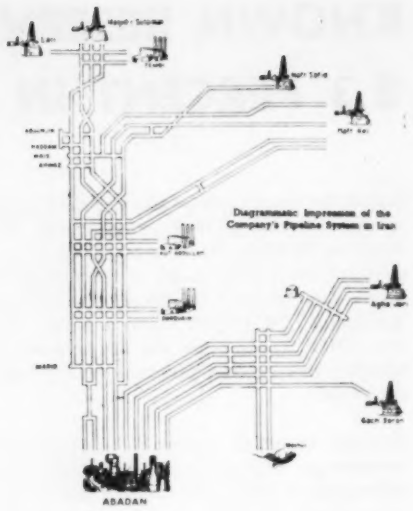
Of the 8,013 holes drilled 4,296 were new field tests, 1951 were new pool tests and 1,766 were outposts. New pool discoveries included 379 oil wells, 87 gas wells and 41 condensate wells, a total of 507. Extensions of old pools resulted in 353 oil wells, 71 gas wells and 31 condensate wells, an aggregate of 455. The number of oil producers was 1,098, while gas producers numbered 255 and condensate producers 110.

For the first time the report includes exploratory drilling in Canada and Mexico. It shows 172 exploratory holes completed in Alberta and Saskatchewan, Canada. They included 38 producers (26 oil, 11 gas and one condensate), and 134 dry holes. In Mexico 29 exploratory drillings resulted in six oil and two condensate producers. The accompanying map shows by states the number of producers and the number of dry holes and (in parentheses) the footage of each.

* Complete report with tables will appear in June A.A.P.G. Bulletin.

# ANGLO-IRANIAN AGHA JARI PIPELINE NEARS COMPLETION

By E. Lawson Lomax



Diagrammatic Impression of the Company's Pipeline System in Iran

LATEST addition to the pipeline system of Anglo-Iranian Oil Co. Ltd., is the line from Agha Jari to Bandar Mashur, which is now approaching completion. This line extends from the Agha Jari field to a new port at Mashur near the Bandar Shahpur terminus of the Trans-Iranian railway. The port at Mashur is already handling about 3.5 million tons of export crude per year, this oil being bled off the Agha Jari-Abadan lines at Mashur manifold by 2 x 12-inch lines to the port.

The existing Agha Jari-Abadan pipelines consist of 3 x 12-inch lines from Agha Jari field to Mile 19; 5 x 12-inch lines from Mile 19 to Mile 40.4 (Mashur manifold), and 4 x 12-inch lines from Mashur manifold to Abadan.

Total capacity of these lines is 9.3 million tons per year of fully stabilized crude, of which about 3.5 million tons is at present bled off for export, leaving the remainder for delivery to the refinery.

At the present time there is only one gathering station in the Agha Jari field, at which multi-stage stabilization is effected. It is planned to bring lines from other gathering areas to Mile 19 and to erect a boosting station at Mashur, thereby increasing the capacity of the system.

To expedite shipments pending construction of further units of this type, it was decided to group gathering lines from new wells and tanks in which crude could be flash-stabilized and then transported to Mashur in a large-diameter gravity line. The new line will be in full operation by the end of 1949 and will have a capacity of eight million tons per year flash-stabilized crude oil solely for export, but even by May it will have a capacity of six million tons.

Preparation of the right-of-way and construction of tankage was begun in 1947, and all material required, together with the necessary mechanical equipment, is on site, so actual completion of the project is expected to take place as scheduled.

The diameter of the line is 20—22 inches. The pipe was fabricated by Western Pipe and Steel Co. of San Francisco. The two sizes were nested for shipment to reduce freight charges. The 20-inch pipe is of ¼-inch thickness, and the 22-inch is 5/16-inch thickness, except for a portion laid in the hill country which is 20 x ⅜-inch.

Flash-stabilized crude is shipped through the line, and no pumping stations between the charging tanks and shore tanks are required, the fall being from 1320 feet at the field gathering tanks to a maximum of 80 feet at the export tanks when these are full.

There is a sharp fall from 1320 to 125 feet in the first five miles of the line, in which the maximum gradient is one in 2.5, and it is in this section where the pipe is not buried that the heavier 20 x ⅜-inch pipe is used. The choice of the heavier walled pipe for this section of the line was dictated by various conditions such as the steep nature of the ground, possible falls of rock and great temperature changes in surface-laid pipe. These changes of temperature are of the order of 100°F over the year, with maximum changes of 50°F in a day. In accordance with the company's practice, the line is staggered in dog-leg form to take care of the changes in length engendered by these variations of temperature and is laid on supports to avoid ground corrosion and reduce friction. The average width of the pipe tract in this section is 25 feet.

In the desert section where the gradient is from 125 to 40 feet, the line is being buried to a maximum cover of two feet eight inches. This course was decided upon after mature consideration by committees of experts and scientists in spite of the fact that the major portion passes through corrosive soil. It has the advantage, however, of reducing the temperature fluctuations.

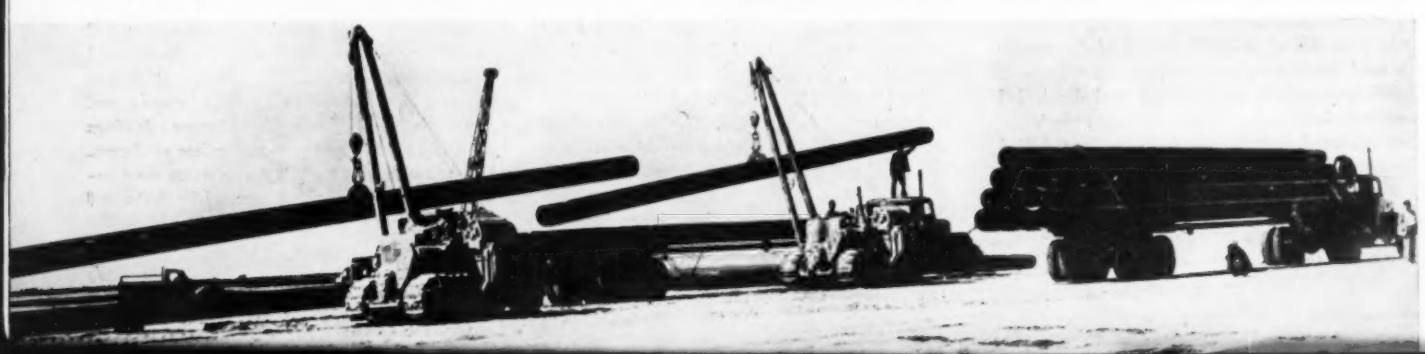
Protection against corrosion is being provided for both by wrapping and cathodic methods. The wrapping consists of a first layer of Fibreglas pulled into a petroleum bitumen enamel which is manufactured in the refinery at Abadan, and this primary layer is covered with a layer of bitumenized asbestos felt as a mechanical protection for the Fibreglas. This is contrary to the general practice of using coal-tar bitumen for this purpose, but a very complete investigation, both chemical and physical, carried out for this purpose indicated that coal-tar bitumen offers little or no advantage over petroleum bitumen as an anti-corrosive and has the disadvantage of having to be imported, thus raising the cost considerably.

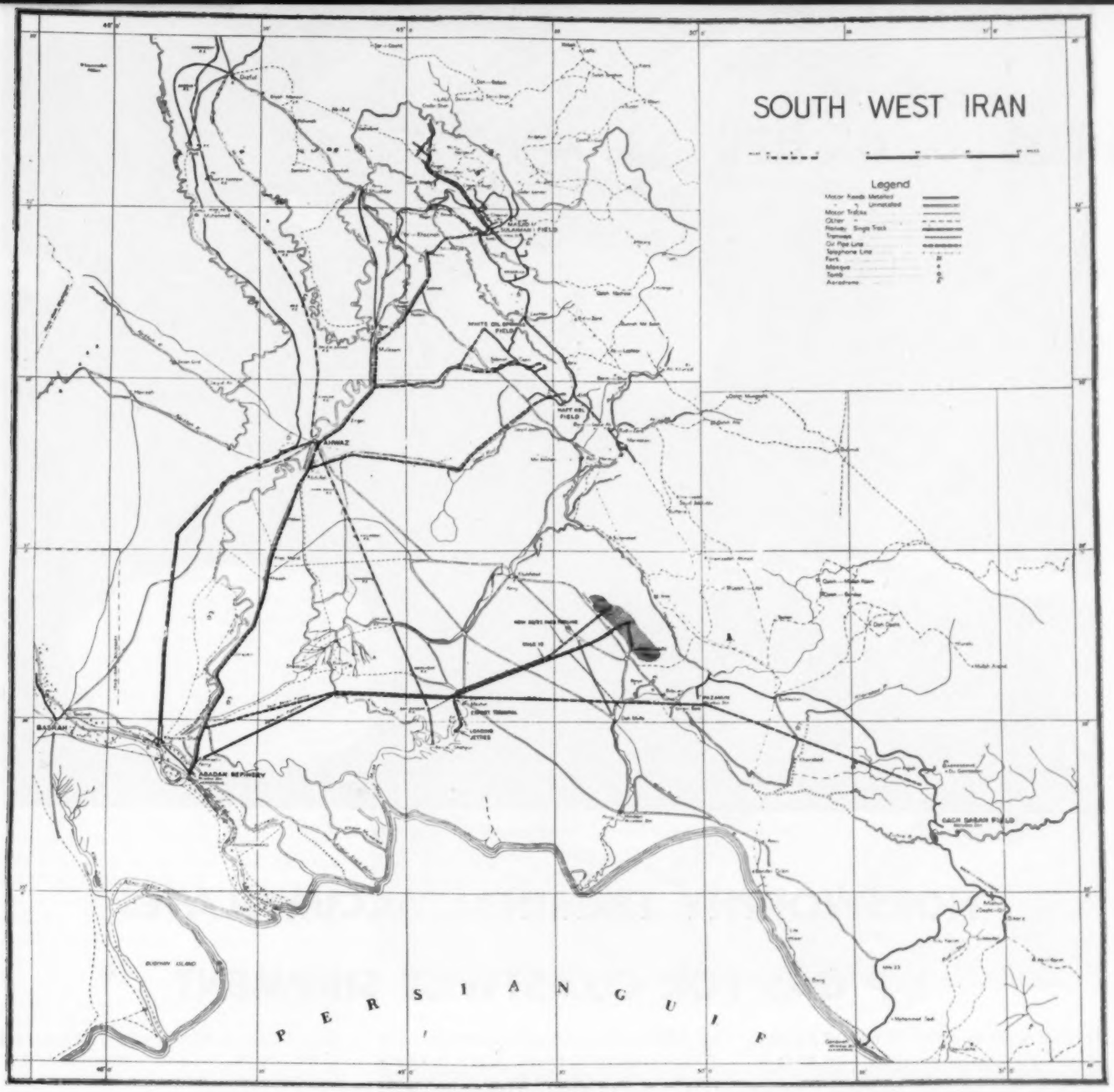
Cathodic protection is applied immediately the pipe is laid. For this purpose the generators of welding sets are being used for power, pending the installation of a transmission line from Abadan power station from which the necessary power for this purpose can be bled.

Pipes are welded into pairs at Mashur and then transported to welding dumps at four-mile intervals along the line. At these dumps they are welded into 360-foot lengths. These sections then are moved into position over the trench, welded to the line, machine-cleaned, primed and wrapped and then lowered into the trench and the latter backfilled. Welding is done under staff supervision by Iranians who have been trained in the company's workshops.

The total length of line employed in the new project is about 50 miles from field to foreshore, while in addition there are sufficient loading and transfer lines in the tank farm to assure prompt and expeditious loading of the export crude to conform with requirements.

The lines are at present fed from two gathering tanks on the field. Export facilities at Mashur consist of five tanks, each of capacity 4.7 million gallons, from which tankers are loaded by centrifugal pumps of sufficient capacity to load a tanker between tides.





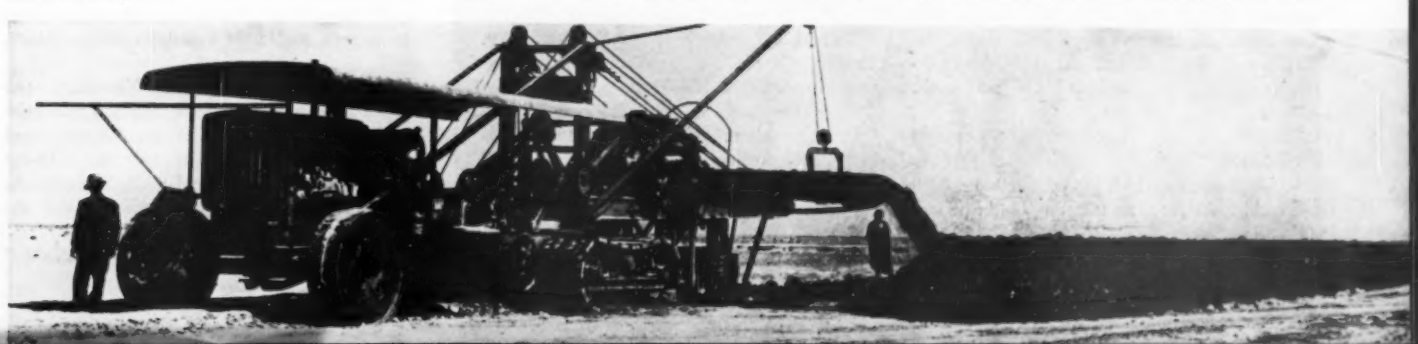

The development of Bandar Mashur to handle eight million tons yearly will include installation of 12 crude oil tanks of 130,000 barrels each and others of like size for diesel and fuel oil, besides measuring tanks for these products. The crude tankage is filled at present by 2 x 12-inch lines from Agha Jari. These in time will be replaced by the new 20-inch line. The bunker tanks are filled from tankers by a 12-inch back bunkering line from the jetties.

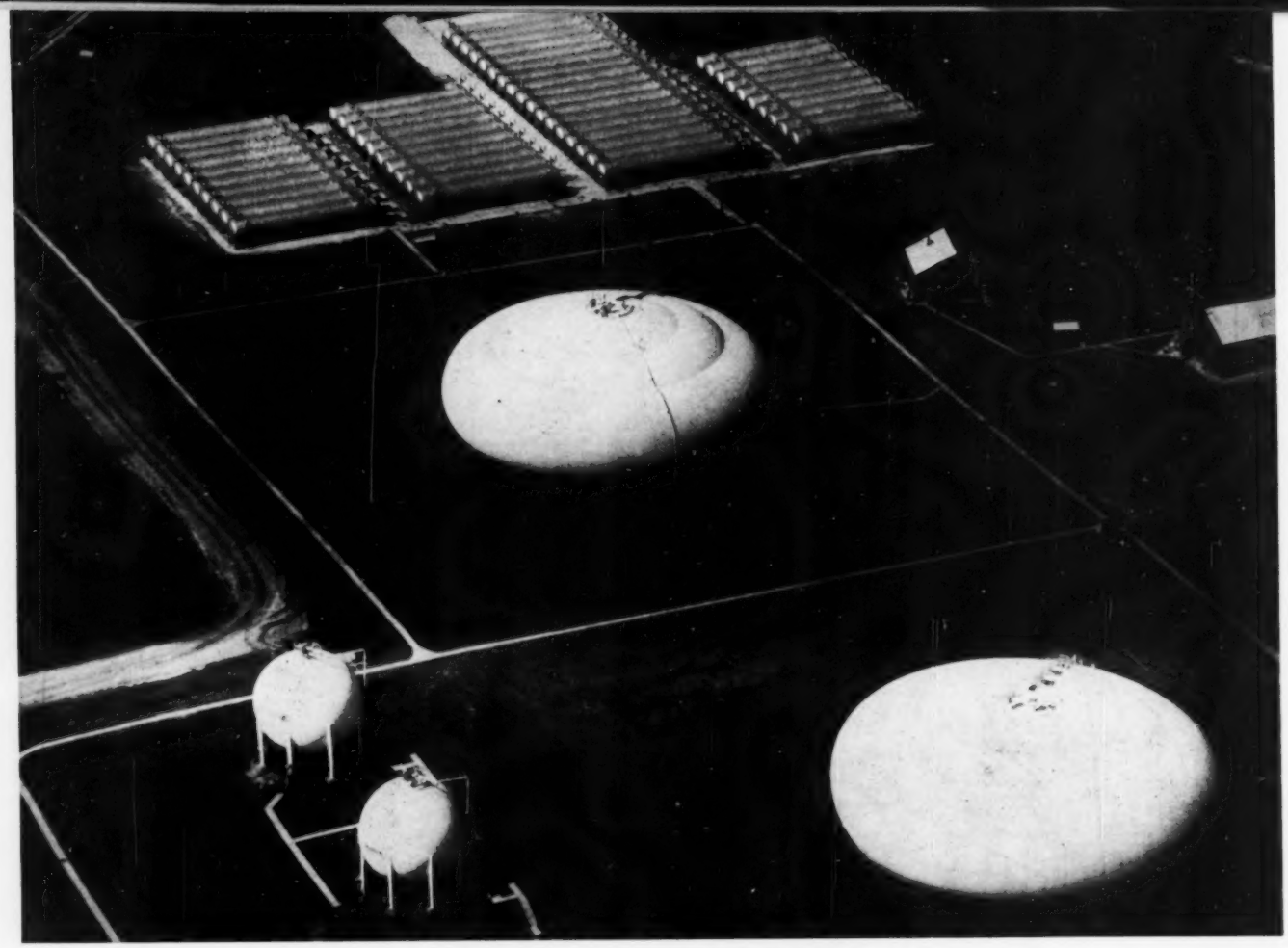
Crude oil is pumped from tanks to jetties by electrically driven pumps through 6 x 12-inch lines, 4.5 miles long. Bunker pumping from tanks to jetties is by 3 x 700 tons-hour diesel driven pumps via 2 x 12-inch lines, 4.5 miles long.

Crude pipeline capacity is to be increased by the installation of a 20-inch line between tanks and foreshore manifold. On the installation of this line, one or two 12-inch lines will be transferred to bunker duties, thus permitting simultaneous bunker loading and back-bunkering.

All the above tanker loading lines will be manifolded at both foreshore and tank farm ends so that crude and bunkers may be distributed from any tank to any jetty.

There are at present two mooring berths. These facilities will be expanded to four jetty berths for the final eight million tons yearly scheme.





Aerial view of Norsworthy terminal. Photograph courtesy Chicago Bridge & Iron Co.

# NORSWORTHY TERMINAL ACCUMULATES L-P GAS FOR COASTWISE SHIPMENT

THE tremendous growth of sales of liquefied petroleum gases in recent years has made it necessary for the industry to expand its facilities for storage and transportation in order to keep customers continuously supplied. In 1948 sales of LP-Gas increased 29.5 percent, reaching nearly a million barrels daily, of which a large part is consumed at great distances from the principal points of manufacture.

Warren Petroleum Corp., one of the largest producers and marketers of LP-Gas, has been particularly active in the construction of large storage terminals at points adjacent to consuming centers. A terminal served by tank car was built several years ago at Mobile, Ala. Others since have been built at Little Rock, Ark., and Cedar Rapids and Des Moines, Iowa. Combined storage capacity of these terminals is 150,000 barrels.

In addition to its tank car terminals Warren has been developing a marine operation to supply the East Coast market which has been retarded both by the high freight rates from midcontinent supply points and by shortages of tank cars. The Warren operation at present consists of a loading terminal at Norsworthy on the Houston, Texas, ship channel; a specially built propane tanker, and an East Coast terminal at Newark.

Warren began the development of its Norsworthy marine terminal about 15 years ago. At that time it was built for the accumulation of tanker quantities of natural gasoline for export and for shipment to East Coast refineries. With storage for about 300,000 barrels of natural gasoline, Warren was able to smooth out the seasonal demand curve for its customers and for its own manufacturing plants by accumulating product in the slack months for bulk shipment in the peak fall and winter blending seasons. Present storage facilities for natural gasoline consist of two 100,000-barrel Hortonspheroids designed to operate at 15 psi. and two cone roof tanks with a combined capacity of 93,000 barrels.

Expansion of the terminal to handle LP-Gas was begun in 1947 concurrently with the construction of the LP-Gas tankship Natalie O. Warren, and of the Newark, N. J., receiving terminal. LP-Gas storage until recently consisted of two Hortonspheres with a combined capacity of 11,000 barrels of butanes, and 47 high-pressure 10 by 80-foot cylindrical tanks for the storage of 46,000 barrels of propane.

Since the accompanying photographs of the terminal were made, the propane capacity has been increased to a total of 56,850 barrels by the addition of 14 more horizontal tanks. This will permit the assembly of nearly twice the cargo capacity of the Natalie O. Warren. The Newark, N. J., terminal with 70,000 barrels of capacity also has ample working storage space with more than double the tankship's cargo capacity.

At the time Warren built the Norsworthy terminal for natural gasoline in 1933, the total sales of LP-Gas in the United States did not exceed 2,500 barrels daily. Today, assuming a 15-day turnaround for the Natalie O. Warren, the Norsworthy and Newark terminals and the

Natalie O. Warren can handle about 2,400 barrels daily, almost as much as the nation's demand 16 years ago.

The Norsworthy terminal is equipped to receive product by pipeline, tank car and tank truck. The tank car unloading rack has spots for 12 LP-Gas cars and 49 natural gasoline cars. The truck docks are equipped for either loading or unloading of transports. Unloading of natural gasoline cars is through a 16-inch gravity line to the pump house where pumps take suction.

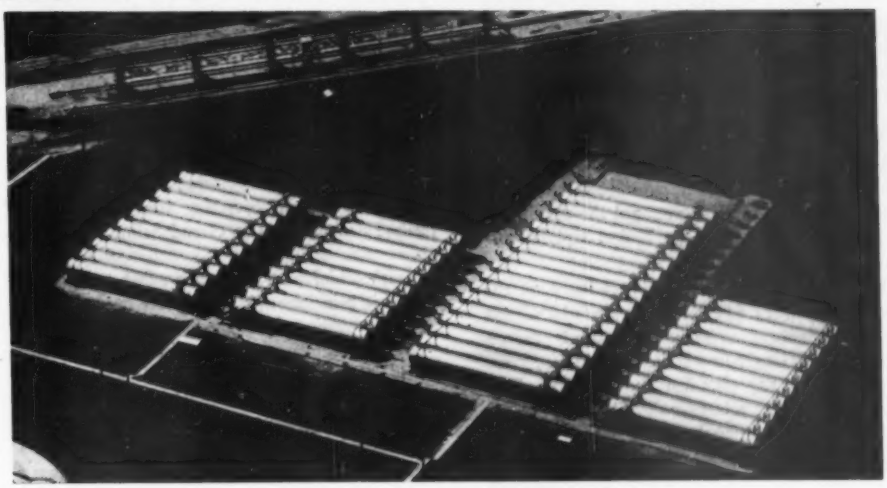
Propane unloading is through a 10-inch gathering line operated with a back-pressure of 225 psi. to avoid vaporization in transit to storage. Protective devices are installed to prevent passage of any propane into low-pressure natural gasoline storage tanks.

The pumping installation consists of eight electrically driven, vertical centrifugal pumps. Two of the pumps have a capacity of 320 gpm. each at a differential pressure of 350 psi. Three pumps each have a capacity of 1,400 gpm. at a differential of 50 psi. Three smaller pumps are provided for lesser flow service. Pumping and manifolding flexibility permits simultaneous tankship loading, tank car and tank truck unloading and outbound pumping of natural gasoline by pipeline to adjacent refineries. The Natalie O. Warren can be loaded with propane at 4,000 barrels per hour and loading thus completed in about eight hours. Loading lines to the ship dock range in size from eight to 12 inches in diameter.

Safety precautions were taken throughout the terminal and on the propane tankship. The propane system contains only steel valves and seamless tubing tested to 1,000 psi. Tanks and loading and unloading facilities are extensively grounded. Dikes around tanks have double the capacity of the tankage. A grass fire fighting system was installed, and the entire area around the propane tanks paved with shell to prevent growth of grass or weeds. Motors are explosion proof. At the ship dock flow of products is automatically stopped in case of a line rupture. This is accomplished by a regulator actuated by line pressure. If downstream pressure decreases, the regulator instantly closes the line.

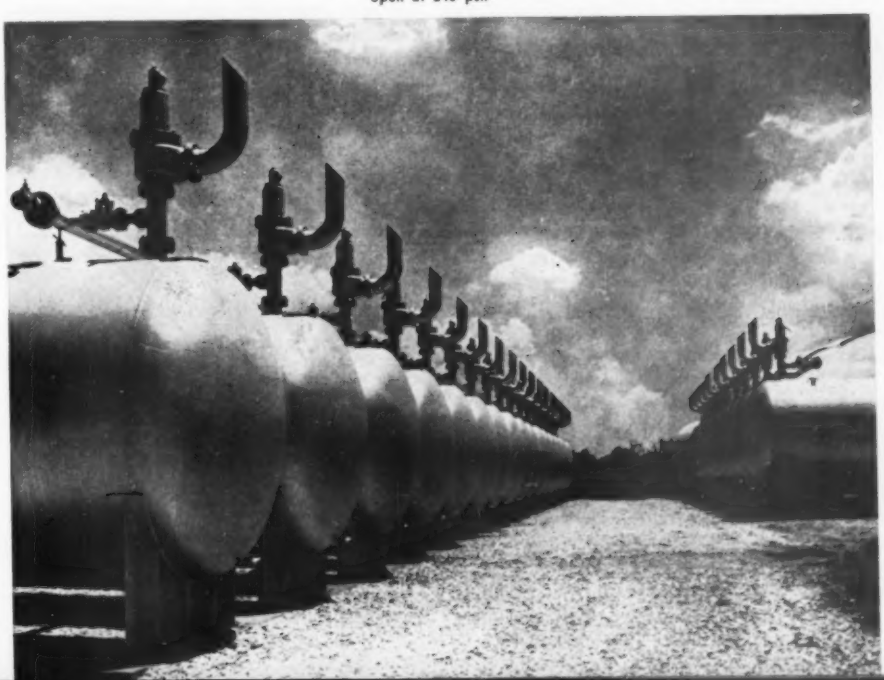
The Natalie O. Warren is a converted C1A dry cargo ship purchased from the U. S. Maritime Commission and converted to a propane carrier by the installation of 68 storage tanks with a working pressure of 250 psi. The ship also is elaborately equipped for safe operation. All tank connections and pumps are above deck. A ventilating system is capable of changing air in the hold every 30 minutes. An alarm system is installed which warns if the hydrocarbon content of air in the hold equals 40 percent of the lower explosive limit. All tanks are equipped with relief valves feeding into a line which vents 60 feet above the ship's deck. Precautions were taken against loss of product due to line breakage, and all valves can be closed simultaneously from any one of nine remote control points. The Natalie O. Warren is the first ship fitted out for the exclusive transportation of LP-Gas.

Battery of propane tanks showing flow control manifolds and steel valves tested to 1000 psi.



Photograph of propane tanks taken before most recent additions.

Propane storage tanks are interconnected to maintain uniform pressure. Relief valves are set to open at 240 psi.



# EXPLORING THE EARTH WITH RADIO WAVES

By Wm. M. Barret*

FROM the late nineteen-twenties to the spring of 1948, the technical literature records the results of many experiments that were undertaken by various investigators in an effort to learn if radio waves could be utilized effectively in exploring the earth in search of mineral deposits.

The results of these experiments indicated that the amount of electrical energy that could be transmitted into the earth and reflected therefrom by mineral deposits was too small to meet practical requirements.

All of which seemed conclusive indeed until December, 1948, when more than two dozen geologists, geophysicists and radio engineers gathered around a radio receiver in an abandoned tunnel of a deep salt mine at Grand Saline, Texas, and listened to the sound made by radio waves coming from a small transmitter located some 1200 feet away on the surface.

To many this event, which was reported in the March issue of WORLD PETROLEUM, represented nothing more than an interesting scientific experiment. To others it presaged the opening of an entirely new field of geophysical exploration.

The more optimistic viewpoint is based on the conclusion that: (1) the success of the Grand Saline demonstration indicates that depth penetration may no longer be a serious obstacle for radio waves; (2) the electrical contrast offered by many important minerals should make possible their direct detection by radio waves, and (3) mineral detection by radio waves should afford inherently high "resolving power" and consequent accuracy, because of the comparatively short waves employed and the feasibility of directing the waves along selected paths.

One has but to remember that all of these favorable characteristics have not been identified with any other form of energy employed in geophysical prospecting to realize why radio waves may open new frontiers in exploring the earth for mineral deposits.

Business and technical leaders of the oil and mining industries have come to the realization that before long a new method of locating mineral deposits will be needed to meet the enormous civilian and military demands of the foreseeable future. The writer believes that radio waves may form the basis for this new method.

The radio-transmission demonstration at Grand Saline was made by engineers of William M. Barret, Inc., and ever since the demonstration its technical staff has been deluged with an increasing number of inquiries from many sources. Some of these inquiries were received from geophysicists and radio engineers who share the viewpoint that the radio method is destined to play an important part in our future prospecting. Most of the inquiries evidenced a serious desire to understand the operating principle of the method demonstrated at Grand Saline.

It is the chief purpose of this paper to outline the basic principles involved in the operation of the new method; to show how it differs from the earlier attempts to employ radio waves in earth exploration, and to point out its implications in the field of geophysical prospecting.

The thought of locating minerals by electrical means is not new. It has long been known that the electrical properties of many minerals differ markedly from those of the materials that enclose them in nature, and numerous attempts have been made in the past to develop electrical methods that would disclose directly the presence of buried mineral deposits.

To obtain sufficient "resolving power" to reveal clearly the presence and location of a mineral deposit, it is necessary that the electrical energy flowing in the earth be concentrated along suitable paths. This requirement seems to eliminate direct current and low-frequency alternating current, but immediately suggests high-frequency electromagnetic waves, such as radio waves, which may readily be directed along selected paths.

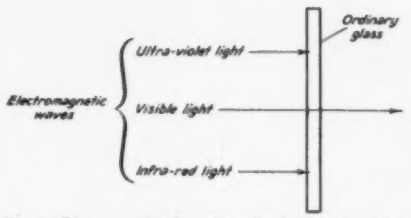



Fig. 1—Diagrammatic illustration of selective absorption.

In general, however, if the frequency were made high enough to permit convenient and effective directivity, then the waves entering the earth would be absorbed after traveling but a comparatively short distance therein. And too, but a small percentage of the wave energy leaving the antenna actually would enter the earth, for most of the energy would be reflected at the earth's surface, in much the same manner that light waves are reflected by a mirror. On the other hand, if the frequency of the waves were lowered to overcome excessive absorption, the reflection at the earth's surface would increase in many cases, and to maintain controlled wave paths would require an antenna system approaching the size of a modern office building.

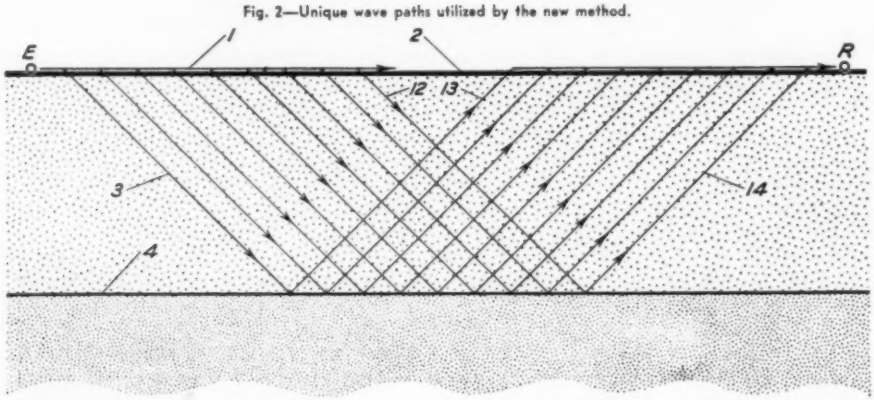
These were some of the problems faced in developing the method used in the salt-mine demonstration. How they were overcome successfully will be understood from what follows.

For many years it has been the conventional belief among geophysicists and radio engineers that the absorption (or attenuation) suffered by an electromagnetic wave in traveling through the earth necessarily increases rapidly as the frequency of the wave is increased. Barret engineers could not, however, agree with the conventional viewpoint, for their studies indicated that geologic strata are characterized to a degree by what the physicist terms "selective absorption," that is, they will transmit electromagnetic waves of a particular frequency band or bands with far less absorption than other frequencies.

These findings were supported by the fact that most materials in nature are characterized by selective absorption. A familiar example of this phenomenon is ordinary glass (Fig. 1), which transmits light visible to the eye, or visible elec-

*President, William M. Barret, Inc., Consulting Geophysicists, Shreveport, Louisiana

Fig. 2—Unique wave paths utilized by the new method.



tromagnetic waves, but absorbs most of the ultraviolet and infra-red waves on either side of the visible spectrum. Ordinary glass is thus transparent for visible waves, but substantially opaque for waves of higher or lower frequencies. Research investigations developed the fact that underground strata behave in a somewhat similar manner, and that radio waves of the proper frequency may under certain conditions be transmitted to considerable depths in the earth.

But the frequencies thus arrived at were ill adapted to the transmission of waves past the air-earth boundary, or for concentrating the wave energy along controlled paths, each a fundamental requirement. There simply was no apparatus or technique then available for satisfying these requirements under field conditions, and it accordingly became necessary to develop a basically new mechanism to solve the problem.

This finally was done in the manner illustrated diagrammatically in Figure 2. Radio waves of the proper frequency are fed into a unique type of radiating device E, which directs a "surface wave" 1 along the air-earth boundary 2. As the surface wave moves to the right, "rays" progressively peel off by refraction and enter the earth along a multitude of parallel ray paths, such as the path 3, and travel downward toward a reflecting formation (or mineral deposit) 4, where the rays are partially refracted downward and partially reflected back to the earth's surface 2, and again refracted to the receiver R. All of the reflected rays reaching the receiver are in space phase and time phase, that is, they are "in step" in both space and time, and all of these rays therefore reinforce one another in actuating the receiver.

The lowest points of the underground ray paths of Fig. 2 are used to "scan" a subsurface medium (like 4), and thereby reveal the electrical contrast that occurs when a mineral deposit is present. Owing to the difference in the reflecting properties of sedimentary media and many minerals, the presence of a mineral deposit may frequently be disclosed by the character of the rays reflected back to the earth's surface. The surface wave 1 continues to the right in Figure 2, where it mixes with the reflected rays, and thereby acts as a reference wave for clearly revealing the difference in the character of the reflected rays caused by the presence of a mineral deposit.

In practice, the subsurface may be explored for mineral deposits by a simultaneous and like movement of the radiating device E and the receiver R, or by varying the separation (or spread) between E and R, increasing spread corresponding to increasing depth of investigation, and vice versa.

The depth of a reflecting formation or mineral deposit may be measured by determining the spread between E and R when the first reflected energy is received, or by using the surface wave to determine the transit time of the underground rays, or by varying the frequency of the waves

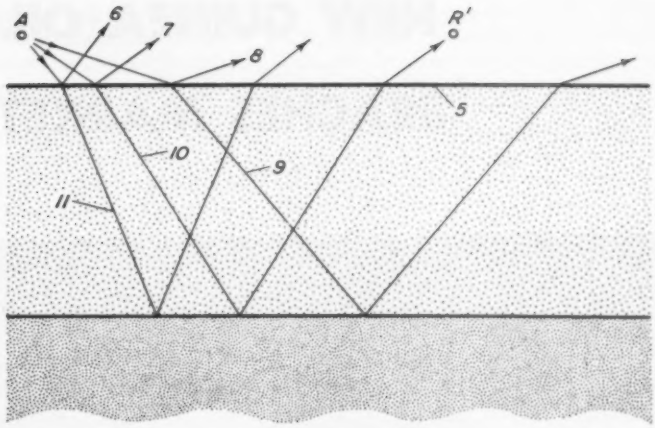



Fig. 3 — Wave paths conventionally employed in earlier attempts to use radio waves in earth exploration.

and analyzing the interference patterns caused by mixing the surface wave with the reflected rays.

By means of the mechanism illustrated in Figure 2, the waves are passed twice through the air-earth boundary under highly efficient conditions, and their underground paths are so effectively controlled that all of the electrical energy transmitted into the earth along the refraction paths shown and returned therefrom by a particular reflector, such as 4, is cumulative at the receiver. The wave energy arriving at the receiver is consequently amplified millions of times over the energy contained in a limited number of rays, such as employed in earlier attempts to use radio waves in earth exploration.

Reference to Figure 3 will clarify this important distinction. In the former experiments the waves have customarily been transmitted from an elevated antenna such as denoted by A. Aside from the fact that most of the transmitted energy was reflected upward at the earth's surface 5, as indicated by the rays 6, 7 and 8, and this energy accordingly was wasted, it is self-evident that any energy that arrived at the receiver R′ must have been conveyed by the ray 10, since adjacent rays, such as the rays 9 and 11, never reached the receiver, and hence the energy that arrived at R′ from depth was necessarily restricted to that conveyed by a single ray, or at best, a narrow bundle of rays.

One of the fundamental concepts of the new method is brought sharply into focus by comparing the narrow ray-path section of the earlier experiments, as indicated diagrammatically by the ray 10, with the wide ray-path section of the new method, as shown diagrammatically by the width of the section bounded by the rays 3 and 12, and by the rays 13 and 14 of Figure 2, which width at times measures thousands of feet.

It is thus seen that the new method differs in three fundamental respects from the methods employed in former experiments: (1) it utilizes frequencies that lead to the effective transmission of wave energy to depth in the earth and thence back to a receiver positioned at the earth's surface; (2) the waves are passed through the severe electrical barrier at the earth's surface with little reflection loss, and (3) the method employs unique wave paths that inherently provide an enormous increase in the amount of electrical energy arriving at the receiver from depth.

The radio-transmission demonstration at Grand Saline was conceived for the purpose of establishing the fact that these novel features make possible the propagation of radio waves through the earth. Realizing the natural reluctance of geophysicists and radio engineers to believe that radio waves could be made to penetrate to depth in the earth, however logical the theoretical concepts involved, it was believed desirable to modify the method somewhat in order to provide obvious proof that the transmitted waves actually traveled through the earth. It was decided that such proof could best be obtained by locating the receiver, which normally is operated along the earth's surface, at the bottom of the salt mine, and then receiving radio signals propagated by a transmitter on the surface. In order partially to compensate for the absence of the reflected-ray concentration that normally occurs at the surface of the earth, the receiver was provided with a special antenna consisting of two long wires that extended in opposite directions along the mine tunnel. The wires were oriented to intercept a considerable number of the refracted rays arriving from the transmitter, and for the comparatively shallow depth involved in the mine demonstration, the combined length of the antenna wires took in a sufficient ray-path section to result in good signal strength at the receiver.

The basic method outlined herein for transmitting radio waves into the earth and receiving them therefrom, and applications thereof to the solution of petroleum and mining problems, have been under development for more than 15 years by William M. Barret, Inc., and its research and manufacturing affiliate, the Engineering Research Corporation. In recent years significant advances have been made in perfecting methods* of locating a number of important minerals; of mapping the structure of a variety of subsurface formations, and of investigating the electrical character of subsurface media *in situ*. In later papers it is intended to describe these methods and show how they are applied in practice.

* Covered by United States and foreign patents and pending patents. At a future date it is planned to make these methods available to the petroleum and mining industries through contract surveys and/or license arrangements.

# NEW GUINEA OIL REACHES MARKET

Fig. 1. NNGPM base camp and marine terminal at Sorong.

Fig. 2. Klamono field camp on Klasafet river.

THE lapse of time between the granting of an oil concession in undeveloped territory and the marketing of petroleum often stretches into years. An example of one of the longest is New Guinea from which the first tanker of crude recently was loaded more than 12 years after the producing company was granted rights to explore. The time lapse, in this case, was nearly doubled because of the wartime shut-down.

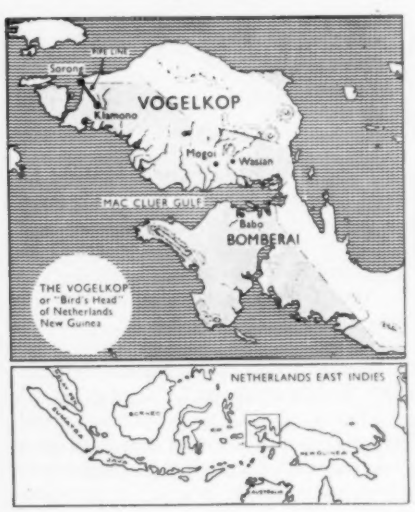
Nederlandsche Nieuw Guinee Petroleum Maatschappij (NNGPM) was organized in 1935 and was granted a concession in 1936 covering 23 million acres of land in the Vogelkop and Bomberai region of northwest New Guinea. After preliminary exploration work the company relinquished about three million acres, reducing the concession to 20 million.

NNGPM is made up of a group of five oil companies. A 40 percent interest is held by Shell through Bataafsche Petroleum Maatschappij, and a similar interest by Standard-Vacuum Oil Co. which is in turn jointly owned by Socony-Vacuum Oil Co. and Standard Oil Co. (N. J.) The remaining 20 percent interest is held by Far Pacific Investments, Inc., which is in turn owned by The Texas Co. and Standard Oil Co. of California. Shell is the operating partner in the New Guinea venture.

When the concession first was granted the island of New Guinea, although the largest island in the world, was perhaps the least known. Most of the island is covered with a dense equatorial jungle which is drenched with tremendous rainfall. Last June, for example, the rainfall at the NNGPM marine terminal at Sorong totaled 120 inches in the 30-day period. Inland from the swampy jungle are towering mountains.

Because of the difficulties involved in traversing the island, NNGPM took to the air for reconnaissance. An area one-fourth the size of California was completely photographed from the air, and excellent base maps were available for geologists within a year.

Fig. 3. Map showing NNGPM concession on the Vogelkop.



First wildcat well was begun at Klamono in February 1939. A heavy asphaltic oil of 19-20 API gravity was discovered at depths ranging from 300 to 650 feet. The oil is produced from miocene lime in a dome of limited extent.

Development of Klamono proceeded more rapidly than elsewhere in the concession, although oil of superior quality was discovered at Wasian and Mogoi. The Klamono property was more accessible, being on the Klasafet river which is navigable by small river craft from the coast some 40 miles distant. An accompanying photograph illustrates how the Klamono camp was hacked out of the jungle along the river.

By the time the war broke out, 14 wells had been drilled in Klamono, of which eight were productive. As a result of the war NNGPM lost about 90 percent of its equipment. Nothing much was left when the Japanese were defeated except the geological data which had been accumulated before hostilities.

Operations at Klamono were resumed in 1946. The work involved construction of a marine terminal at Sorong where incoming supplies and equipment are assembled, warehoused and distributed to various working areas. An accompanying photograph from the air shows the layout of this terminal with its housing, office and warehouse facilities.

Although the Klasafet is navigable for small craft, it was deemed essential to build a road and pipeline to develop the field. The 32 miles of jungle intervening presented a formidable task, but the road has been built and it has been paralleled by an eight-inch crude pipeline.

Prior to completion of the pipeline small amounts of crude had been produced at Klamono for use as fuel in local operations, but none had been marketed. In the first half of 1948 production totaled only 4,400 barrels, and cumulative production of the field from date of discovery was only 12,295 barrels.

Fig. 4. Tree slab walk leading to Quonset hut occupied by field workers.

As soon as the pipeline was completed to Sorong and tankage erected, the operators increased production of the field to about 4,000 barrels daily, and the first tanker was loaded in December 1948. It was estimated at first that the road and pipeline could be completed in a year. Actually two years were required to get the job done. Not far from Klamono exploratory work has been in progress with a hand-powered rotary rig as illustrated in an accompanying photograph. This rig drilled 1,842 feet in the first half of last year with the drawworks being operated entirely by hand. A small motor was carried into the drilling site to provide mud circulation and electric lighting. The rig was used principally for stratigraphic reconnaissance. Good use was made of abandoned military equipment such as metal land strip material at the drill site.

Fig. 5. Laying the 8-inch crude line through the jungle from Sorong to Klamono.

Fig. 6. Hand-powered rotary drill and derrick complete with mud circulation was carried into the jungle by New Guinea bearers.

Fig. 7. An outboard motor has been added to this New Guinea native dugout for use by NNGPM geologists.

Fig. 8. Aboard a NNGPM launch are E. M. Butterworth, president of American Overseas Petroleum Co.; T. L. Lenzen Standard of California eastern hemisphere operations manager; L. A. deLaive, New Guinea resident manager for NNGPM; and F. C. Sealy of The Texas Co. foreign producing department.

As indicated on the map, two other fields have been discovered in New Guinea by NNGPM. Both were brought in before the war and neither is yet being produced commercially. The Wasian and Mogoi discoveries are near the Temboeni river, which is very difficult to navigate, so it is essential to provide overland transportation facilities before production can be put on a commercial basis. Currently a 45-kilometer road is being built from the Wasian-Mogoi area to tidewater so that drilling equipment may be moved in to test potentialities of the two discoveries, each of which still consists of a single well.

At Wasian a well was drilled to about 3,225 feet in 1940. Miocene lime was topped at 2,900 feet. Oil from the well is paraffinic in character with an API gravity of 48°. The miocene lime was topped at 1,250 feet at Mogoi the same year. Here the oil tested 46 gravity.

Rehabilitation of the facilities installed before the war and the construction of new facilities has given employment to very large numbers of local workers. As has been the case elsewhere in the East Indies, the New Guinea islanders learn easily and make fine field employees. It is essential, however, that they retain an interest in the job if they are to work regularly. In recent months the NNGPM has employed as many as 9,000 in its various operations on the Vogelkop.

Farther east on the great island outside the Netherlands zone, Australasia Petroleum Co. (Standard-Vacuum 40 percent, Anglo-Iranian 40 percent, and Oil Search Ltd. 20 percent), has stepped up its exploratory work. The deep wildcat at Kariava in Papua was abandoned at 12,621 feet, but two more drilling rigs are being added to the three now operating in the eastern region. Of the wells currently drilling one is at Hohoro near the mouth of the Vailala river, another is 25 miles up at Upoia, the third is 60 miles northwest of Port Moresby at Oroi.

One of the new rigs on order is capable of reaching depths of 10,000 feet or below. A British seismic crew recently joined the Papua search. Recent reports are that the Poroi wildcat is drilling ahead.

Oceania and the Orient still are greatly deficient in oil, so the urge is strong to develop supplies at points where high transportation costs for long sea voyages from the Middle East can be avoided.

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Figures 1, 4, 6, 7, 9 and 10 with this article are reproduction of photographs supplied through the courtesy of Standard-Vacuum Co. Figures 2, 3, 5 and 8 are published through the courtesy of Standard Oil of California.

Fig. 9. With dynamite and bulldozers to help, it took two years to clear a path from Klamono to Sorong and lay 30 miles of line.

Fig. 10. New Guinea tribesmen are good workers in jungle fields.

General view of refinery.

# CONTINENTAL COMPLETING NEW MONTANA REFINERY

SIGNALIZING the rapid development of the oil industry in the Rocky Mountain area is the refinery of Continental Oil Company at Billings, Montana, now under construction by Jones and Laughlin Supply Company and scheduled for operation in the final quarter of this year. The plan embodies unusual features, as it is designed to process a high sulfur (2.2 weight percent), low-gravity (28°API) crude blend consisting of 60 percent of Elk Basin crude of 29.6° API gravity and 40 percent of light Frannie crude of 25.5° API gravity. Design capacity is 7,555 barrels daily.

Entering the refinery crude will pass through conventional heat exchange equipment and a large oil heater into a single flash tower at 800°F. From this primary tower all light oils through 600°EP diesel oil will flow as a vapor through the desulfurizing reactor to a single fractionator which will produce a 250°F end point product overhead, which is subsequently stripped of butanes and lighter in a stripper stabilizer.

Four strippers are provided for side stream distillate cuts from the secondary tower. Part of the heavy side cuts and all of the bottoms containing catalyst fines will be returned to the catalytic cracker. The desulfurizer will operate at about 700°F and will circulate about 25 tons an hour of catalyst. This light oil portion of the crude represents approximately 47 percent of the charge. An unstripped virgin gas oil side stream comprising 15 percent of the crude charge will be taken from the primary crude tower for catalytic cracking charge.

The remaining 38 percent bottoms stream from the primary crude tower will flow directly into the propane deasphalting unit, where propane at some 17,000 barrels daily or a 5.7 ratio to charge will separate about 2,000 barrels per day of virgin gas oil from the 1,000 barrels of asphalt in the 3,000 barrels of topped crude.

The fluid cracking unit is of the conventional design except that a second reactor, the desulfurizer, has been added. One regenerator 23 feet by 50 feet will operate with both reactors. Twenty-five tons an hour of catalyst will be circulated through the desulfurizer. In addition 500 tons per hour will be circulated in the catalytic cracker. The initial catalyst charge will be 175 tons of silica-magnesia type catalyst. Feed to the catalytic cracker will consist of about 2,000 barrels daily of heavy gas oil from the deasphalter, 1,100 barrels of unstripped virgin gas oil from the primary crude tower, and 650 barrels daily from the secondary crude tower, making a total fresh feed of 3,750 barrels daily. Total case charge will be 8,550 barrels daily including the 4,800 barrels of recycle. The reactor temperature will be 900°F. The structure for this unit is 150 feet high.

The vapor recovery system will recover the propane-butane fraction from all plant gases as feed for the catalytic polymerization unit. A novel feature here is the double contactor tower system used in the $H_2S$ removal unit. The vapor from the first-stage compression discharge drum will be contacted with DEA-solution in one tower, then compressed through the second stage to the final 260 pounds pressure. Liquid from the first stage discharge drum will be contacted with DEA in a second tower, then will rejoin the vapors from the second compression stage before entering the fractionators.

The catalytic polymerization unit and after fractionators are of the conventional type for recovery of LPG propane-butane and stabilized catalytic polymerization gasoline. Two tubular reactors using a steam generating system for temperature control will be employed.

The desulfurized straight-run gasoline and catalytic gasoline will be sweetened in a treating unit rated at 4,750 barrels daily capacity. The butanes will be treated in a twin case 500-barrel unit. Distillates will be doctor sweetened.

A total tankage of 438,000 barrels is being provided for finished and intermediate storage in 30 tanks. Included in this group are five 500-barrel LPG tanks, a 10,000-barrel spheroid for casinghead, a 120,000-barrel base gasoline tank and the usual other tanks. Storage is also provided for 10,000 gallons of sulfuric acid and 12,000 gallons of caustic. Floating roof tanks are being supplied by Chicago Bridge and Iron Co. for gasoline storage.

Steam for the plant will be produced in 175-pound steam generators on the catalytic cracker and by two 650-pound pressure 90,000-pound-per-hour boilers. Process heating will be done with 175- and 40-pound steam. Forty-pound steam will be used for process stripping. Utility heating will be done with 20-pound steam. Condensate will be returned through a high-pressure hot system and a low pressure cold system.

Corrosion resistant tower linings are provided for many of the units by the use of clad sheets requiring only one seam weld. A light sheet of 11-13 chrome steel or similar alloy is fused at the mill to a heavier sheet of steel to provide strength in making clad materials. The bimetallic sheet can then be fabricated as though it were a solid sheet of corrosion resistant metal. This type of material has been used in making all of the larger equipment with a sizable saving in fabrication costs.

The refinery is designed to produce from the crude mixture mentioned previously approximately 58 percent of 10-pound Reid vapor pressure gasoline with clear unleaded octanes of 73.5 motor method and 80 by the research method. Design yields of other products are: LPG, propane and butane, 3.5 percent; middle distillates 15 percent; and fuel oil and asphalt 22 percent.

Other features of the plant are the truck loading rack with a capacity for loading four transport trucks simultaneously, the marketing warehouse, 12 double-spot tank car loading rack, the refinery office.

# FUEL PROBLEMS OF THE NEW AUTOS

By Eric Eltham

Torque converter under test at new Shell Oil Co. hydraulic fluids research laboratory.

AMERICAN passenger cars for 1949 have one thing in common. There has been a determined effort on the part of the manufacturers to give the public the opportunity to get more miles for its transportation dollar. This has not been accomplished by reducing the cost of the original investment. Factors still beyond the control of the auto makers, such as high cost of materials and labor, have tended to keep prices up, and in most cases the new models cost more than their predecessors. The general trend has been to design today's car so that it is a more efficient vehicle.

This attempt to reduce operating cost stems from the realization of the manufacturers that the cost of motoring is reaching the point where it is becoming a decisive factor in the choice of an automobile. And not the least of the items entering into the overall operating cost is the cost of gasoline. Once considered as a negligible item, gasoline now accounts for about one-third of the cost of motoring. In large measure gasoline taxes are responsible for this condition. They have steadily increased through the years, and today in some cases are equivalent to the refinery cost of the fuel. It is not surprising, then, that the emphasis in nearly every case is on more miles per gallon, not only for the light family cars but for those in the luxury classes as well.

This is the first year that all makers have offered a truly postwar car. All lines have come out with low and rakish bodies, more glass and wider front seats. Studebaker presents the least departure from its earlier models, but this is because of the radical change in body style introduced a little more than a year ago. A newcomer shown this year for the first time is the "hardtop" convertible, a body type that looks exactly like a convertible but with a top that will not disappear. Makers claim that this model has the eye appeal of the convertible and the safety of the turret top sedan. Dodge has announced it will bring out the "poor man's convertible," a roadster with side curtains which has not been seen in a showroom since the late twenties.

The postwar trend of mounting the rear seat in front of the axle to improve the riding qualities in this position made its appearance in the Ford, Chevrolet and Pontiac. Further lowering of the center of gravity is also noticeable, and Hudson has gone so far as to drop the floor so that passengers step down on entering.

Motor makers are well aware of the public's desire to have everything as automatic as possible. The ultimate, of course, is for the driver to be able to step in his car and dial the number of his destination. If the car would do the rest, the owner would experience complete satisfaction. While we may never reach this Utopian stage, there is no doubt that few people today really enjoy driving a car in the sense that we used to drive our Model T's with feet and fingers working overtime on the controls. Through the years, the choke, the spark and the hand throttle have all disappeared, and the gear shift is on the way out. General Motors offers its Dynaflow drive—a hydraulic torque converter with emergency low and reverse planetary gear transmission — on Cadillac and Buick. Oldsmobile and Pontiac have G.M.'s Hydra-Matic transmission which provides fully automatic shifting in all forward speeds as optional equipment.

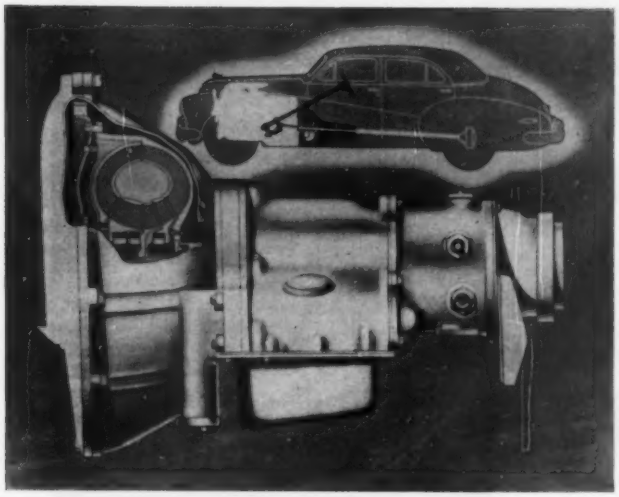
The chief advance that appears in the 1949 models, however, is the engine. Here the trend has been to increase compression ratios in order to effect economies in fuel consumption. General Motors has taken the lead in this direction, which is natural since for many years its director of research, Charles F. Kettering, has been investigating the advantages to be gained from higher compression engines. Tests with laboratory engines have shown that a V-8 engine with a 12 to one compression ratio gives a 40 percent increase in mileage over a similar engine with a conventional 6.5:1 compression ratio. Of course, the higher the compression ratio, the higher the octane number of the fuel required. Until recently the petroleum industry has always been in a position to manufacture fuels with octane numbers higher than those required by the engine manufacturers. Suddenly the auto industry has developed engines with compression ratios of 10 and 12 to one, and the petroleum industry because of material shortages, faces the problem of manufacturing the 100 octane fuels used by these engines in the quantities required. At the moment the industry is engaged in a five billion dollar program to expand its facilities to meet the demand for present grades of fuel. Perhaps by 1952 it will be in a position to produce one barrel of 100 octane fuel for every four of regular automotive fuel, but there is still a question as to whether this will meet the demand.

The highest compression auto engine on the market today is the 7.5:1 Cadillac. This ratio can be increased to 10:1, whenever the fuel is available, by changing the head. This is a V-8 engine that develops a maximum of 160 horsepower and shows a 15 to 20 percent fuel saving over the the 1948 model.

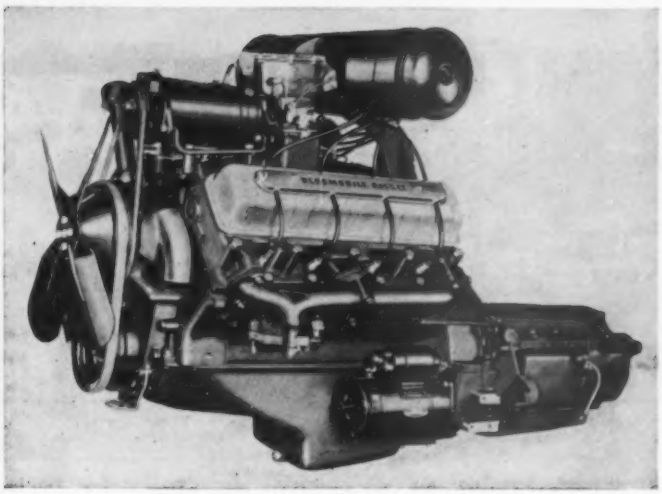
An entirely new engine, based on the Kettering engine, is being used by Oldsmobile in its Series "88" and Series "99" models. This is a V-type eight-cylinder engine with overhead valves actuated by hydraulic valve lifters. Known as the "Rocket" engine, it currently has a compression ratio of 7.25:1, but with only minor mechanical modification this can be increased to 12:1 as soon as higher octane fuels are available. The "Rocket" develops 135 horsepower; thermal efficiency is rated at 26 percent. Oldsmobile claims that special attention has been given to making the engine free from vibration.

Oil refiners and manufacturers of tetraethyl lead rushed to buy new Oldsmobiles for test purposes as soon as they came off the assembly line. Some now have built up road mileages of 5,000 to 6,000 miles, and the industry is beginning to get the "feel" of the new "Rocket" engine. They believe that it will give good service as will the new Cadillac on the better grades of premium gasoline now available when motors have accumulated carbon to the point where they have reached an approximate equilibrium condition.

Recent gasoline quality surveys indicate that the average premium gasoline in the United States has a Research octane rating of 87 compared with a regular grade average of 81.3. Highest rating gasoline is sold in the eastern states where the premium average is 89.1 and the regular 84.4. In the middle west the average is 88 on premium and 80 on regular. Lowest ratings were found



Buick's new 1949 Dynaflow drive.



The new Oldsmobile "Rocket" engine with 7.25:1 compression ratio.

in the western mountain region in the January survey figures being quoted here. The mountain district premium gasoline tested 85.3 octane on the average and regular 78.6.

About two years ago the motor car industry suggested that its immediate goal was the manufacture of cars requiring an octane rating of about 93 Research. The oil industry stated its inability to meet this requirement, so the new "Rocket" motor is supplied on the theory that it will give satisfaction with fuel in the upper eighties but is arranged for easy conversion to higher octane fuels when they become available.

Some motor makers have made "token" increases in compression ratios or are offering optional heads, but the complete redesign such as the "Rocket" engine still is limited.

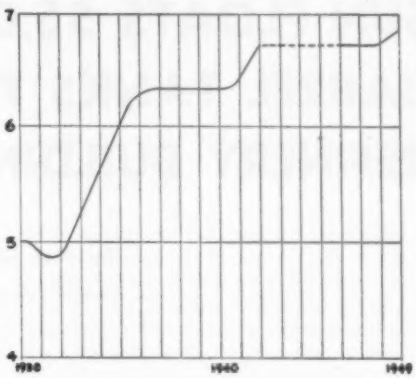
Engine efficiency may be raised by other means than increasing the compression ratio. An interesting step in this direction is the air-cooled engine that is making its reapperance in Army vehicles. Developed by Continental Motors, this engine with a 6.5 to one compression ratio is claimed to be more efficient than the 12:1 compression ratio Kettering engine. However, its cost precludes its general use in automobile engines in the near future. Automatic transmissions, overdrives, supercharging and other methods have been suggested also as means of improving car mileage.

Two solutions to the fuel problem have recently appeared. The first is the dual fuel proposal of William Holaday of Socony. This suggestion is based on the fact that only under heavy loads do high-compression engines require high-octane fuels. Aircraft engines are similar in this respect, and quite frequently aircraft operators employ a high-octane fuel for take-off and switch to a lower grade fuel for cruising. Holaday envisages a similar procedure for automobiles employing two fuel tanks, separate fuel lines and two carburetors. For starting or rapid acceleration the high-octane fuel system would be used, while for normal driving the other fuel system using regular grade fuel would come into use automatically.

The same principle underlies the Vitameter development of Thompson Products Co. This device, which is already on the market, is relatively simple and can be installed on existing automobiles without great difficulty. It employs a mixture of tetraethyl lead, water and alcohol that is injected into the manifold when added power is needed. Like the water injection system used on modern aircraft, it cools the cylinders and the lead increases the octane rating of the fuel by 10 to 20 units. As compression ratios go even higher, the effectiveness of the Vitameter will increase.

While there is no doubt that the number of cars using high compression ratios will grow, it is not improbable that the demand for fuels of 100 octane number will increase at a slower rate. Developments like the Vitameter and the dual fuel system can make it possible for these engines to operate on present-day fuels. The high compression engine can bring about a reduction in fuel consumption, or to put it another way, give more miles per gallon of fuel. A conservative estimate of the fuel savings possible is 10 percent, which is equivalent to a saving in the nation's fuel bill of $450 million annually or an increase in mileage of 31 billion.

From the point of view of the supplier of petroleum products, the question of the all-purpose chassis lubricant is assuming importance. These greases are compounded with barium and lithium soaps. Already some of the major refiners have put such lubricants on the market, and although they command a premium, they are preferred by consumers because of the time saving they permit. Fluids for hydraulic transmissions are exceptionally stable mineral oils with high viscosity indices. They contain additives to prevent oxidation and foaming. In general they are supplied by the car manufacturer, though some petroleum companies are considering putting out their own fluids for replacement purposes. Regular drain periods are recommended by General

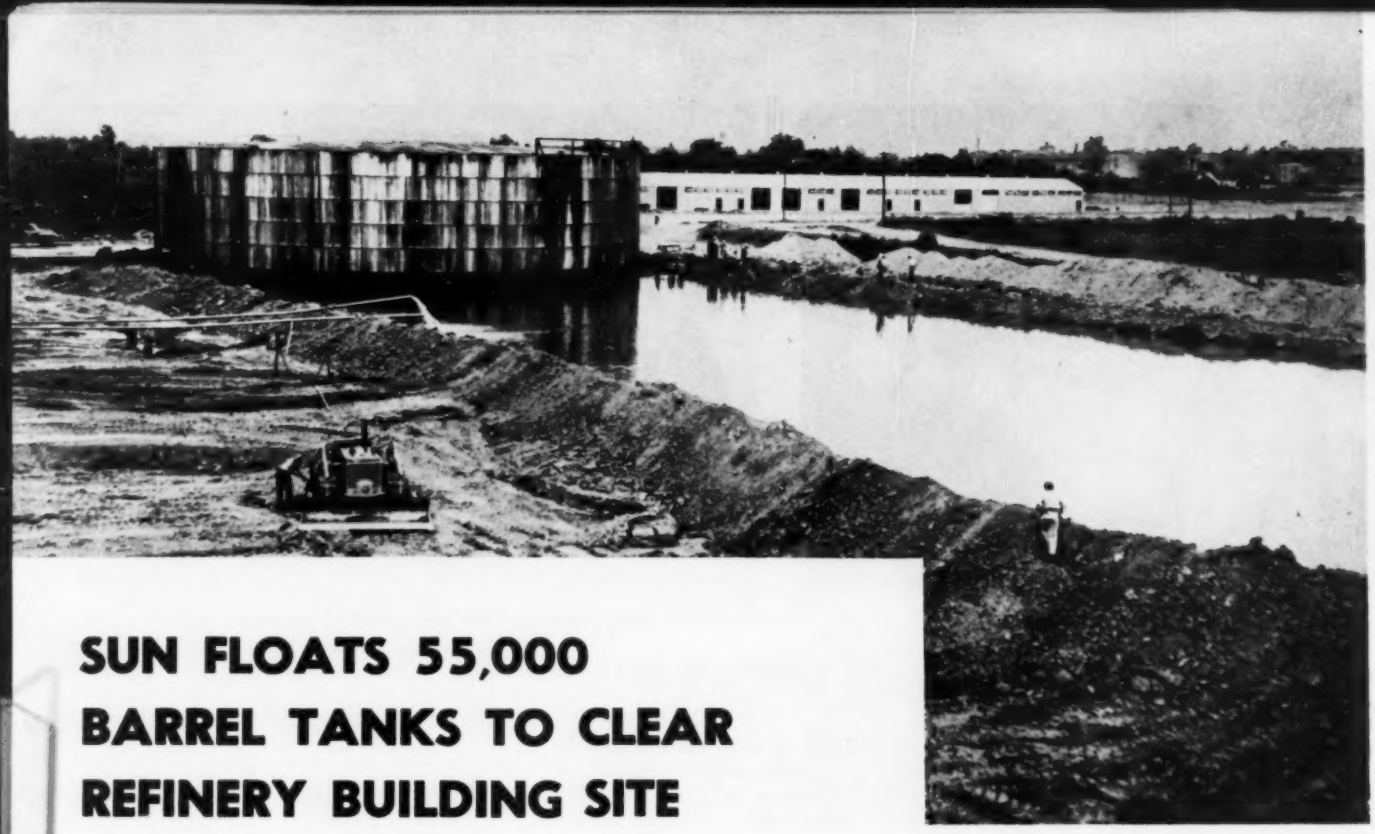



Trend of average passenger car compression ratios.

Motors for Hydra-Matic and Dynaflow transmission. Chrysler, on the other hand, only requires that the fluid level be maintained.

At the 1948 meeting of the American Petroleum Institute the lubrication committee selected a group to determine whether torque converter oils can be reduced to a single standard grade and whether servicing can be done at oil filling stations. A report of progress on this assignment recently was made to the committee which suggests that a single fluid will do the work and that procedures are not too complex for the filling station attendant.

Research into the fluids used by cars and other types of machinery is being undertaken on an increasing scale by various oil companies. Shell Oil Company, for example, is opening a new hydraulic laboratory at St. Louis. F. S. Clulow, Shell vice president, said in announcing the new research that there is reason to believe that fluids may eventually be used to operate built-in jacks, to power steering mechanisms and to raise and lower tops, hoods and windows. Other possible uses include the operation of constant-speed generators and of temperature-regulating devices. The first would extend battery life; the second would prolong engine life by insuring adequate temperature control during cold weather, light-load operation as well as in sustained driving at high temperatures.

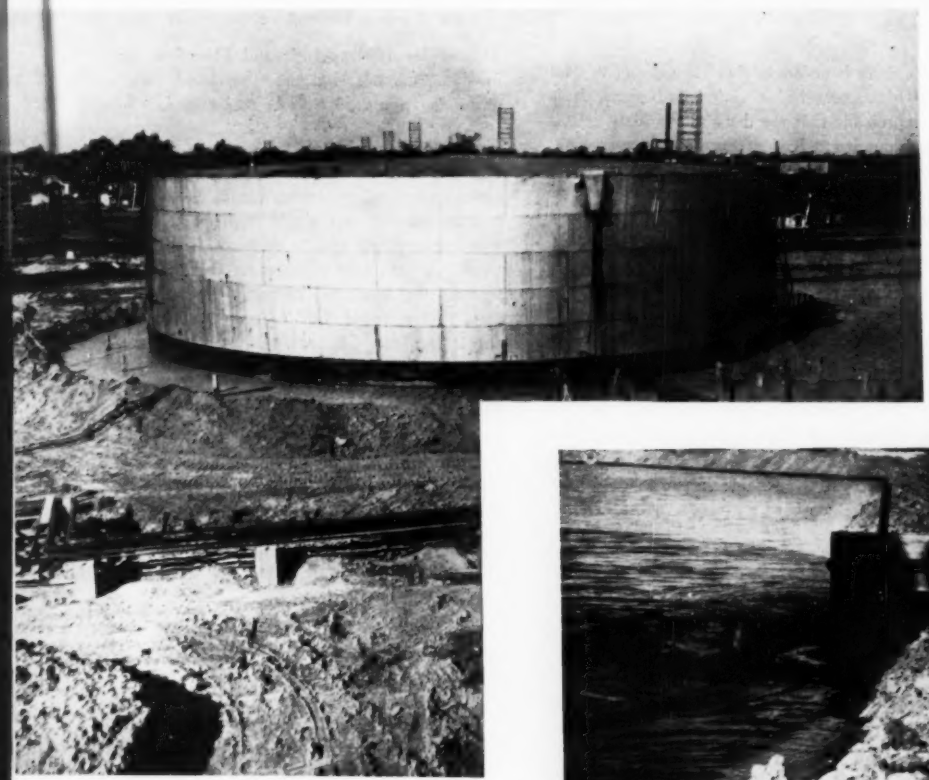


# SUN FLOATS 55,000 BARREL TANKS TO CLEAR REFINERY BUILDING SITE

By Alan McCone

Catalytic Construction Co.

↑ Pumping water into canal for floating tank No. 153 on its first lift.



← Tank No. 152 being moved into its new position.

↓ Bulldozer raking dike to release water from canal.

SUN Oil Company recently completed the moving of five 55,000-barrel storage tanks by floating them to new locations. This operation was done to clear the site for the company's $18 million refinery expansion in Toledo, Ohio. Each of the tanks was 114 feet in diameter, 30 feet high and weighed approximately 200 tons. As shown in Table I, one of these tanks was moved 1,510 feet in a 4.25 million gallon canal. Catalytic Construction Co. was contractor on the job.

The method of moving these tanks by floating in a prepared canal was chosen because it was both less expensive and less damaging to the tanks than either dismantling the tanks or skidding them. The moving of the tanks was broken down in the following four operations: (1) Preparing the tank, the new foundations and the dikes; (2) the transportation; (3) the orienting and setting of the tank; and (4) the disposal of the water.

Each tank was prepared for floating by emptying its contents, saving it and cleaning it thoroughly. Next the bottom was inspected for holes, and these holes were plugged or welded shut. The clean-out door was then replaced and all connections in the bottom ring were closed with blind flanges, pipe caps or welded, depending on the type of connection. This procedure made the tank watertight up to the level required for floating. At this time three lugs were welded on the top of the bottom ring for attaching the towing cables.

The foundation for the new tank was made up of a clay base with a three-inch crown in the center. Around half of the foundation away from the entrance for the tanks, five posts for steadying the tank while it was being set were put in the ground about 30 feet apart, forming about 120 degrees of the circumference of the tank which was to be set. These posts were eight inches by eight inches (oak) and eight feet long. The posts were set five feet in the ground, backfilled and tamped solidly.

The canal for floating the tanks was laid out so that it would serve for the movement of all of the tanks with a minimum amount of rebuilding of the dikes. Although the tanks would float in 18 inches of water, the dikes were made several times this height in order to provide for clearance in high spots en route and for minor changes in level. When a considerable change of grade was encountered, a lock arrangement was created by building a dike across the canal at the point at which there was the greatest change in grade. This method was adopted rather than raising the water level along the entire route because of the considerable amount of time required to pump the extra volume of water into the canal. When the tank was being moved to a lower grade, the dike was first built across the canal to a height sufficient to accommodate the water necessary to float the tank in the upper level. Earth for this dike was taken from the canal area so that when the dike was broken, it was not necessary to move the earth out of the canal.

The tank was then floated to the face of the dike and the dike broken to permit the tank to settle to the lower level. When the dike was levelled off, the tank was floated into position. When necessary to move the tank up-grade, it was floated in the lower canal for the maximum distance and then a dike built behind the tank of sufficient height to hold the water necessary to float the tank into position at the higher grade. During the period in which the dikes were broken, the tank was held firmly in place by cables. Although it has been indicated that tanks of this size would float at 18 inches, it was necessary to pump to a depth of approximately 24 inches in order to create enough buoyancy to free the tank from its old foundation. Before the tank was freed, however, two cables, running from the previously attached lugs, were connected to bulldozers on either side of the canal, and these were used to pull the tank along the canal. The second bulldozer was used to control the tank in moving rather than for power, since under calm conditions the tank could be moved by several men. Sometimes it was necessary to place a third bulldozer in the pond to push or pull the tank over a high spot rather than risk damage to the tank by too great a pull by the other bulldozers. Under windy conditions only one bulldozer on the windward side was required with another in the canal pushing or pulling the tank. During the moving of the tank, one or more men were inside the vessel plugging leaks with wooden plugs. Also a crew was constantly watching for leaks in the dikes and repairing those that occurred.

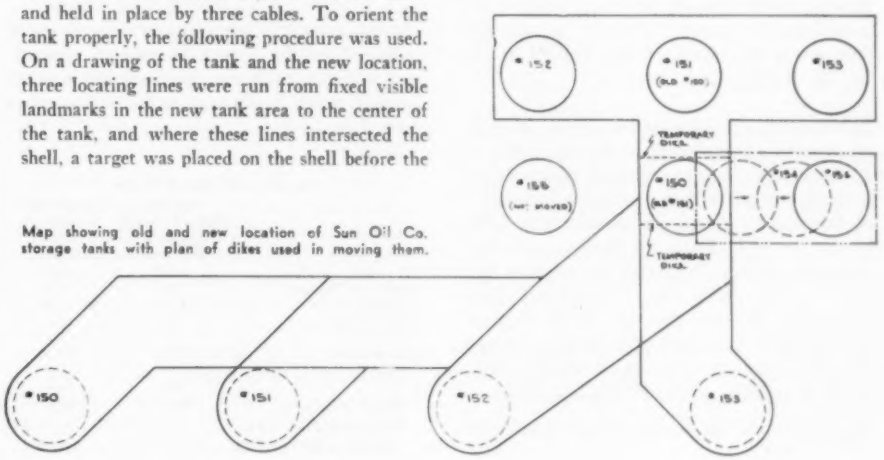
When the tank reached its new location, it was drawn into the semicircle of posts described above and held in place by three cables. To orient the tank properly, the following procedure was used. On a drawing of the tank and the new location, three locating lines were run from fixed visible landmarks in the new tank area to the center of the tank, and where these lines intersected the shell, a target was placed on the shell before the tank was moved. When the tank was about to be set, three transits were set up on the lines between the landmarks, and the center of the tank and the tank was oriented by shifting it around until the proper targets were sighted on the vertical cross-hairs of the corresponding transits. The tank was moved into final position by slackening one cable and tightening the others, or revolved by a fourth cable which partly circled the tank from one of the lugs attached for this purpose. When the tank was set, all lines were held taut before any water was released by breaking the dike.

In an operation of this character, the disposal of such a large volume of water creates a major problem because the uncontrolled flood can wash away the new foundation and undermine existing foundations. The water should be discharged from the pond as slowly as can be allowed. A large ditch will control the water properly outside the pond because the major erosion occurs in the center of the ditch in a vertical direction.

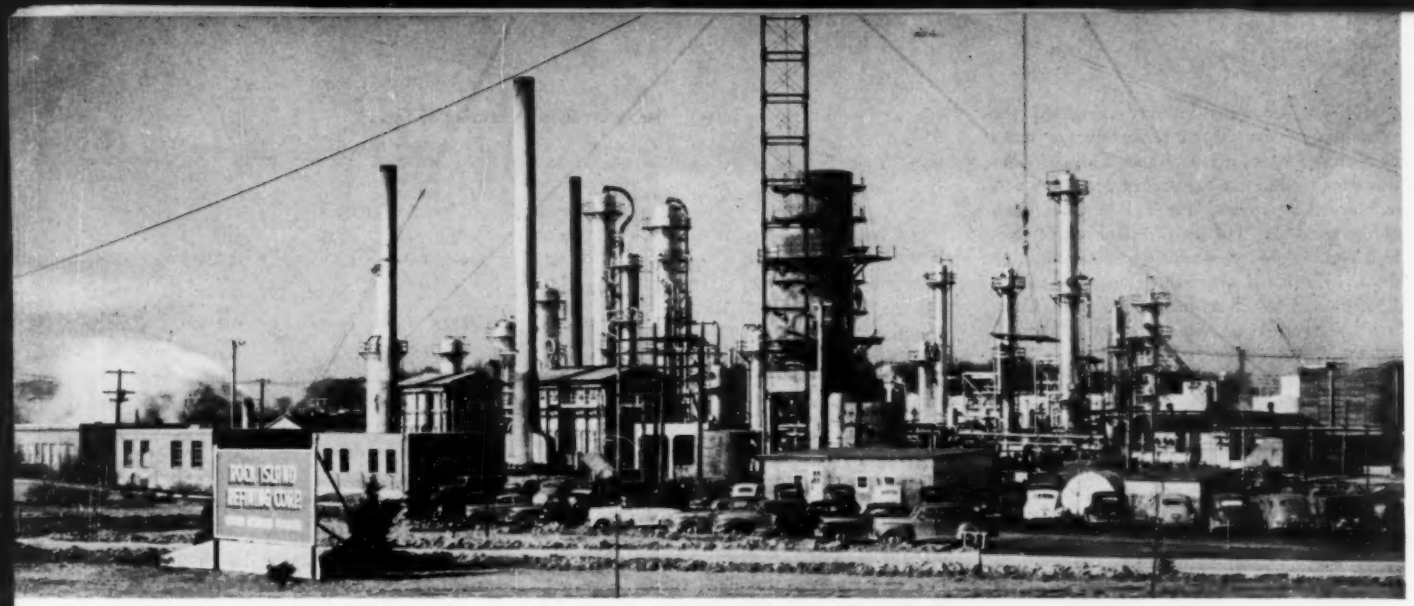
The longest move of 1,510 feet was accomplished in eight hours actual moving time. This was preceded by 72 hours of pumping with pump capacity of 60,000 gallons per hour. The canal contained about 4.25 million gallons, and the move was accomplished with 187 manhours. The tank was in as good condition on its new foundation as when it had been on the old, plus the advantage that the leaks in the bottom had been plugged and subsequently permanently repaired.

**Table I. Data on Moving of Tanks**

| | | | | | |
|---|---|---|---|---|---|
| Capacity | 55,000 Bbls. | | | | |
| Weight | 200 Tons | | | | |
| Height | 30 Feet | | | | |
| Diameter | 114 Feet | | | | |
| Pumping Capacity | 60,000 G.P.H. | | | | |
| Tank Number | 150 | 151 | 152 | 153 | 154 |
| Changes of Grade | 603.80' to 606.50' to 602.50' | 606.50' to 606.50' to 602.50' | 607.70' to 606.50' to 602.50' | 606.75' to 606.50' to 602.50' | 604.05' to 604.05' to 602.50' |
| Man-Hours | 158 | 187 | 160 | 160 | 125 |
| Moving Time (hours) | 8 | 8 | 8 | 8 | 8 |
| Depth of Water (in.) (minimum) | 18" | 18" | 18" | 18" | 18" |
| Volume of Water (millions of gals.) | 2.27 | 4.25 | 4.27 | 4.27 | 2.24 |
| Pumping Time (hours) | 40 | 72 | 72 | 72 | 40 |
| Dirt in Dikes (cu. yds.) | 2000 | 3100 | 2100 | 2100 | 800 |
| Distance Moved (feet) | 920 | 1510 | 980 | 970 | 230 |




Map showing old and new location of Sun Oil Co. storage tanks with plan of dikes used in moving them.



General view of Rock Island Refining Corp. processing area.

# ROCK ISLAND INSTALLS FLUID CAT CRACKER

L. E. Kincannon*

THE original Rock Island plant consisted of a crude oil heater and fractionator, vacuum unit, a combination thermal cracker and reformer and necessary auxiliaries. The rated capacity was 5,000 barrels of crude per day. The plant was designed and constructed by the Winkler-Koch Engineering Company of Wichita, Kansas.

From the first days of operation, considerable thought has been given to more efficient use of waste heat with the result that substantial increases in capacity have been achieved solely by the addition of heat exchange equipment. Within six months after the plant was started, it was able to run 6,000 barrels of crude per day, all the increase being the result of the use of exchangers.

In 1945 a catalytic polymerization unit was installed, capable of producing 250 barrels of polymer per day when sufficient gas was available, thus appreciably raising the octane rating of the overall gasoline output. The poly unit also was designed by Winkler-Koch and licensed by the M. W. Kellogg Co.

In the spring of 1946 a further increase in crude oil capacity was the result of the installation of a Petro-Chem heater, combined with efficient utilization of waste heat. After the installation of this unit, the crude oil capacity was 7,500 barrels per day. Today the plant is capable of processing about 8,500 barrels per calendar day, and all of this increase from the original 5,000 barrels per day has been the result of more efficient use of waste heat with the sole exception of 1,000 barrels per day, which was the result of the installation of the Petro-Chem heater.

Today a UOP fluid catalytic cracking unit of the latest type is under construction. It will have a rated capacity of 5,000 barrels per day and will replace the thermal cracker-reformer which will then be converted to crude distillation service. Upon the completion of this expansion program, the crude charging capacity will be 10,000 barrels per calendar day, with a higher production of improved gasoline and an increase in production of middle distillates and reduction in the yield of residual fuel oil.

Decision to install this unit was reached after observation of the successful performance of a similar UOP fluid cat cracker in the Aurora Gasoline Company's refinery in Detroit. The fluid cat cracking unit was designed by the engineers of Universal Oil Products Co. It is being constructed by the Chicago Bridge and Iron Co. and a Rock Island labor force under Universal supervision.

At this point it is interesting to note the yields produced by the present facilities in comparison with the yields expected from the new cat cracker, which is scheduled to go into operation next July.

Based on Oklahoma Crude

| | Present Yields Thermal Cracking Percent | Expected Yields Cat Cracking Percent |
|---|---|---|
| 80 octane gasoline | 48.5[1] | 50.0[2] |
| Stoddard Solvent | 3.0 | 3.0 |
| Kerosene | 15.0 | 12.5 |
| No. 3 Fuel | 6.5 | 17.0 |
| No. 5 Fuel | — | 3.6 |
| No. 6 Fuel | 22.0 | 10.0 |
| LPG | — | 1.9 |
| Total Recovery | 95.0 | 98.0 |

[1] Requires 3 cc TEL
[2] Requires 1.75 cc TEL

The margin in favor of catalytic cracking as compared with thermal cracking is such that the management of the company feels that the cat cracker will pay out in a relatively short period of time.

The Rock Island cat cracker is basically of the same design as the Aurora unit and has been so planned as to incorporate existing equipment as far as possible. For example, the fractionator on the thermal cracking unit was large enough in diameter to handle the capacity of the new cat cracker. It had sufficient trays to fractionate the gasoline, and space to permit installation of additional trays and pans to fractionate between the furnace oil and heavy cycle fuel oil, but it did not have enough space to permit recirculating column bottoms for washing out catalyst fines and for taking out the small amount of slurry oil; hence, it was necessary to install a small auxiliary column for this purpose.

The catalytic polymerization unit, previously mentioned, is large enough to handle the cracked gases. It removes the olefins from the gas in the form of polymer gasoline. The higher paraffins from the poly unit effluent, aside from the butane required for controlling gasoline vapor pressure, will be liquefied in a new LPG unit and sold as commercial LPG to local distributors.

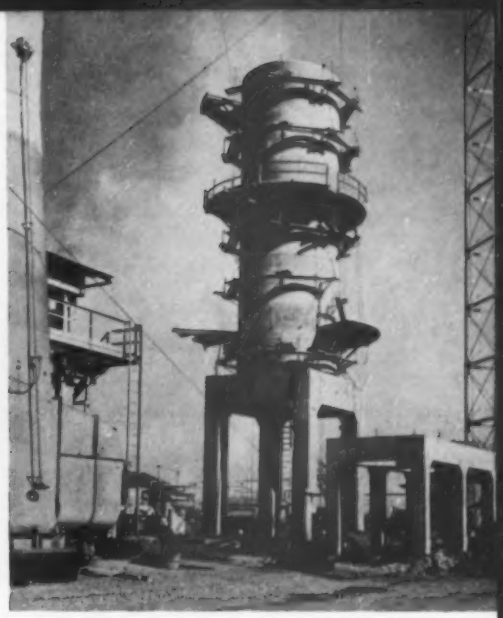
Five thousand barrels per day of charging stock enters the cat cracker from the crude unit at about 500°F., and is joined by about 2,000 barrels a day of heavy recycle from the fractionating column and 250 barrels a day of slurry oil returning entrained catalyst to the reactor.

This combined feed of 7,250 barrels a day en-

* Vice president and general manager, Rock Island Refining Corp.

L. E. Kincannon, vice president and general manager.

L. E. Winkler, president.



Reactor-regenerator of new UOP fluid catalytic cracking unit during construction. Photograph was taken Feb. 9, 1949.

ters the bottom of the riser where it contacts hot catalyst descending from the regenerator, is vaporized by the heat in this catalyst and carries the catalyst up into the bottom of the reactor. The oil vapor rises through the reactor and leaves by way of cyclone separators that remove practically all of the catalyst, and goes into the bottom of the auxiliary column.

A large stream of oil is recirculated from the bottom of the auxiliary column through a steam generator and back over the lower eight pans of the auxiliary column. This stream serves the dual purpose of washing down catalyst and condensing about 500 barrels per day of heavy slurry oil.

This slurry oil is taken from the pump discharge to the slurry settler, where half of it is clarified and taken to storage. The other half, carrying the catalyst, is recycled from the bottom of the settler to join the combined feed.

Vapors from the auxiliary column pass to the bottom of the main fractionating column, the bottoms from which are pumped to four streams. Stream one is cooled by a steam generator and recycled over the lower six pans of the fractionating column in order to control split between furnace oil and heavy fuel oil.

Stream two is pumped back over the top of the auxiliary column as reflux. The third stream forms the 2,000 barrels of recycle to the combined feed, and the fourth stream is stripped and goes to storage as heavy fuel oil.

Furnace oil from the center well in the fractionating column is circulated through another steam generator and returns to the column three decks above, for cooling and assisting in heat balancing the column. The furnace oil product flows from the center well through a stripper and is pumped to storage.

A small naphtha stream is taken from the fourth deck of the column, stripped and used as a sponge medium in the top of the absorber. The distillate and gas pass overhead from the column and are condensed in the conventional manner.

As contrasted to the Aurora unit and wartime cat crackers, the function of the fractionating tower has been split between two vessels, removal of catalyst carry-over and residual fuel oil being done in an auxiliary column. In order to save space and economize on vessel construction, this auxiliary column and the slurry settler, although functionally distinct, were constructed as one unit and separated into two compartments by a head.

In the design of the Aurora unit a simple stair tower with platforms bracketed from the reactor and regenerator vessels replaced the enclosing steel structure, extensive platforms and passenger elevator used in the large wartime cat crackers. Since experience at Aurora indicated that very little service was required above the elevation of the spent catalyst slide valve, a further economy has been introduced at Rock Island by terminating the stair tower at this level. Access to the platforms above is by a ladder similar to that used on fractionating columns.

The Rock Island refinery is located in an area where reliable electric power is available at a low cost; hence it is used for the major part of the power requirements. The main air blower, one of the two gas compressors and most of the pumps are electrically driven, thus reducing essential steam requirements to those for stripping and for operating some of the pumps. By using charging stock hot from the crude unit, it is unnecessary to heat it by either heat exchange or direct firing. Hence, heat from the column side circulating streams is used for steam generation. This steam, together with that from the flue gas steam generators, provides a surplus of steam for use in other parts of the refinery.

A study of the fuel gas available from the unit and requirements for heaters in other parts of the refinery indicates that there may still be some fuel available for the boilers, and it is proposed to operate them at such a capacity as to use up surplus fuel gas or at least carry a small load to control steam pressure. Some of the larger stand-by pumps and one of the air compressors are steam operated, exhausting to a jet condenser for efficient steam use. Thus, a part of the load may be shifted from electric to steam in order to consume steam produced by surplus fuel gas.

Rock Island Refining Corp. has an interesting history. It was organized in 1940 by two well-known members of the oil industry, L. E. Winkler and L. B. Simmons. Mr. Winkler was a former partner in the Winkler-Koch Engineering Company and is now president of Rock Island. Mr. Simmons was president of the Rock Island Refining Company which then owned a refinery at Duncan, Okla. The writer, at that time, was associated with Mr. Simmons as general manager of the Duncan refinery.

The site of the present refinery, a 110-acre tract 12 miles northwest of the center of Indianapolis, was selected after a thorough study of the midwest area from the standpoint of crude availability, transportation and marketing possibilities. The final choice, which has proved to be sound, was made on the basis of the following facts:

(1) Four transcontinental pipelines cross central Indiana not far from Indianapolis. Arrange ments had already been made with one of these lines to transport our crude before the final decision on the site was made.

(2) There was no other refinery in the immediate area.

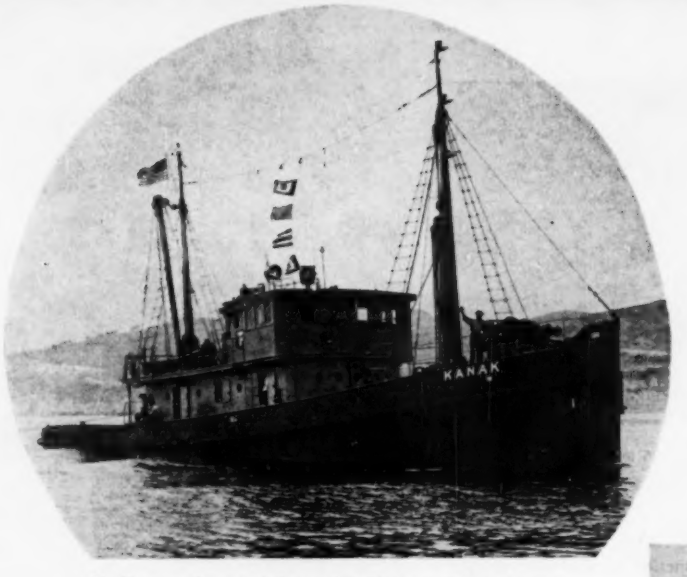
(3) A large part of the retail gasoline and furnace oil business of Indiana was handled by independent jobbers, marketing under their own brand names, and a preliminary study had indicated that they would welcome a local independent refinery as a dependable source of supply.

(4) Indianapolis being a manufacturing center, the near-by industries offered a market for the heavy fuel oil.

While the plant was under construction a six-inch pipeline, 20 miles long, was laid to bring in Oklahoma crude from Jamestown, Indiana, where it was delivered by the transcontinental line.

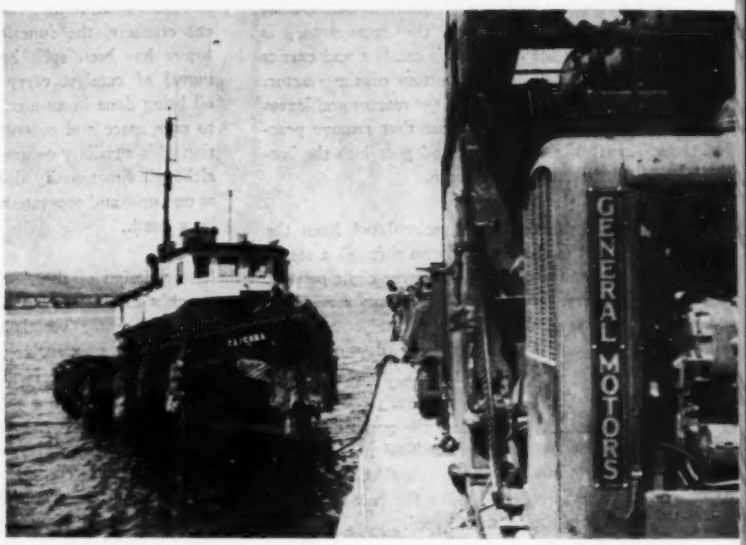
# DIESELS IN

## Signal Oil & Gas Company In Santa Rosa Island Operations Use Diesel Engines in Many Applications



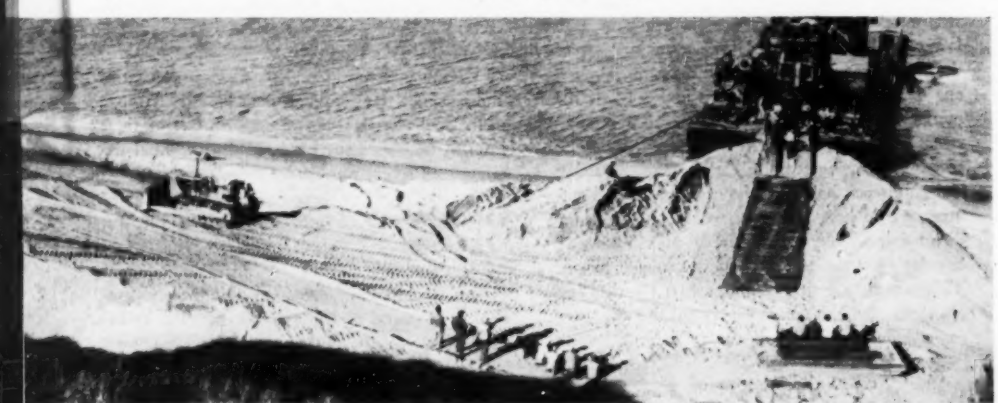

Machinery equipment of the tug "Kanak" is comprised of an impressive group of diesels and accessories. Main propulsion units are two 350-hp F-M diesels, replacing steam. A 200-hp Cummins diesel driver, an I-R compressor, and there is an F-M 30-hp diesel-compressor unit and an F-M 15 kw diesel-generator set.

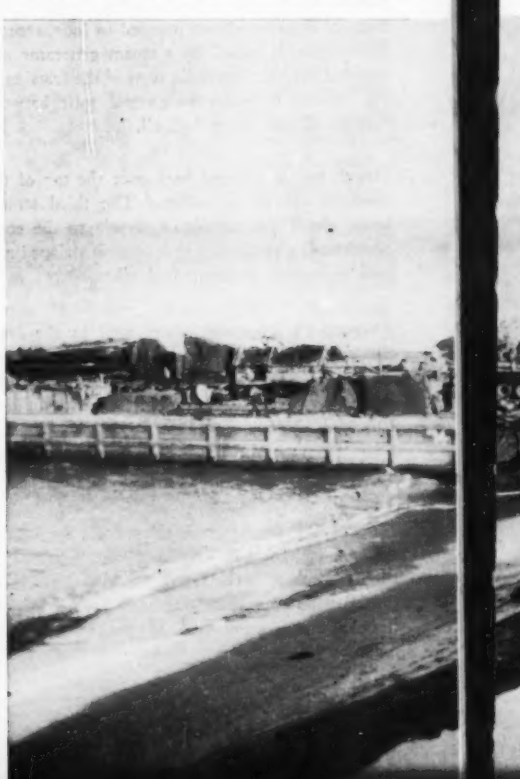
↓ Signal Gas and Oil Company's 136' YMS, La Busca, powered with three General Motors 500-hp diesels for propulsion and auxiliary power.




↓ First below: Tractor, at left, holding barge in snubbed position. Blitz rig ready to unload. Second below: Tractor pulling blitz rig off of barge.

↑ Patcona, 75' tug, is powered by a 240-hp F-M diesel. Note G-M diesel-generating set on barge in foreground.





# EXPLORATORY DRILLING

SANTA ROSA ISLAND, about 17 miles long and 10 miles wide, in the Pacific Ocean 30 miles southwest of Santa Barbara, Calif., has an inhospitable coast line, a rugged terrain, no road system and little population. The big Vail Ranch interests run several thousand cattle on the island where there is enough rain to nourish the green stuff that the animals chew.

Signal Oil & Gas Company, with headquarters in Los Angeles, believe there is oil under the island and they are taking major steps to find out. In all of the operations leading up to the actual drilling and in the drilling, diesel engines play a prominent part. In fact they furnish the power for practically everything that goes on except some trucking and the Allied Air Service planes used for fast transportation of personnel and emergency supplies. Even in the heavy aspects of trucking, "Caterpillar" diesel-powered tractors do the pulling and pushing as will be seen.

Signal's 136-ft. YMS, *La Busca* is powered with three 500-hp. General Motors diesels for propulsion and auxiliary power (including the ship-to-shore radio). This vessel plies back and forth from Stearn's Wharf in Santa Barbara to the Vail Ranch pier jutting out from the island, close to ranch headquarters, as required to carry personnel and freight. However the pier is of too light construction to sustain the weight of heavy drilling equipment; therefore it was landed from beached barges.

After preliminary preparations had been made, in late August 1948, the first, heavy barge load of equipment was towed from Long Beach to the landing beach at Beecher's Bay at the mouth of Water Canyon. The converted, 75-ft. Army tug *Patcona*, powered with a 240-hp., 6-cyl. Fairbanks-Morse diesel, towed the first, 120-ft. x 34-ft., 900-ton capacity barge. The cargo included two D8 "Caterpillar" tractors, road grading equipment, water tanks, trucks, trailers, diesel fuel tanks, and 30,000 ft. of pipeline.

Later barge loads were towed by Pacific Towboat & Salvage Co., Long Beach, tug *Palomar*, with an Atlas Imperial, 400-hp. diesel for main power, and a 20-kw., 2-cyl. GM diesel-generating set for auxiliary power; and by their 120-ft. x 24-ft. *Kanak*, with twin screws driven by two 350-hp., 8-cyl. Fairbanks-Morse diesels.

The Vail "Caterpillar" RD-7 tractor with bulldozer and pull-grader were used to prepare the beach and re-work five miles of old road to the camp site. Camp erection was completed early in September, with mess hall, shop and generator buildings included. A 15-kw. GM Delco diesel generating set mounted on a trailer supplies power for the camp—lights, refrigerators, deep freeze units; motors to operate drill presses, grinders, welding equipment, etc. in the shop.

Tractors were used to grade six miles of new road from the camp to the site of the first well, Soledad No. 1. For two weeks water was tank-hauled from the Vail water supply while a new water tank was erected and connected with a pipeline to a dammed-up spring in Water Canyon.

In October everything was ready for the second, 900-ton-barge load of drilling equipment. This was unloaded in the same manner as barge 1. The barge was beached at high tide. A sand ramp was "dozed" up to the end of the barge. Heavy ropes from each side of the front end of the barge were run through pulley blocks attached to "dead men" (buried posts) and then the two tractors on each side, to hold the barge firmly on the beach.

A bridge was laid from barge to ramp, with a track beyond it on the ramp. Then the low-bed trailer carrying the Blitz Rig was pulled off with one of the tractors. Followed then, the removal of the mud pump and other equipment and supplies. Two "Cats" pulling and one pushing were used going up the nearby grade with each heavy trailer load.

The equipment brought on Barge No. 2 consisted of Santa Fe Drilling Company's Indreco drilling unit; the Blitz Rig, drawworks using a 671 GM twin diesel through a torque converter for power with another 6-71 hooked to a 7¼ x 14 Gardner-Denver compressor; the mud pump with duplicate pumps powered with two 6-71 GM twin diesels; and the 25-kw., 3-cyl. GM diesel-generating set for auxiliary power. With the 12 ton rotary table and base, the drilling equipment proper weighed about 105 tons; other miscellany weighed about 60 tons, and there was also about 100 tons of Kelly drill pipe, drill collars, pipe, blocks, etc. All of the equipment was then pulled by the "Cats" over the old and new road to the well side, set up and ready to drill in November.

Barge No. 3, a smaller, 90-ft. x 30-ft., 400-ton unit, brought over a light load of miscellany and returned the trailers. Barge No. 4, the same unit, delivered two loads of pipe and the Electrical Logging Truck.

Caterpillar tractor pulling unloaded blitz rig up hill while mud pump comes off barge.

Diesel-engined, portable oil well drilling rig under erection at site of well, Soledad No. 1.

# International News and Notes

Clifford B. Marshall

**CLIFFORD B. MARSHALL** has been elected a director of Standard-Vacuum Oil Co. A veteran of 29 years' oil industry experience, Mr. Marshall has been general manager of Standard-Vacuum's India division, including also Pakistan, Burma and Ceylon since 1944. He first joined the company in 1920 and since has marketed petroleum products in Madras, Calcutta and Bombay. During World War II as assistant division general manager, he was instrumental in Standard-Vacuum's efforts to furnish high-octane gasoline and petroleum products to United States and Allied air, ground and naval forces in India, Burma, Ceylon and some sections of China.

## Exhaust Gas for Repressuring

A new wrinkle in repressuring for secondary recovery is reported from the Oberg field in Germany. The case concerns a small field which was opened in 1919 and which by 1935 was equipped for artificial gas drive. By 1940 the supply of natural gas for pumping back into the formation had become insufficient. An attempt was made to supply the deficiency with generator gas from a coke installation, but the scarcity of coking coal and rising costs of operation forced the abandonment of this proposition.

Finally, the engineer in charge, Dr. Ulrich Nehese of Westercelle, conceived the idea of using the exhaust gas from the diesel engine that was used to drive the compressor. The exhaust gas was cooled and pumped into the input wells, but extensive corrosion of the fittings was found to occur from the presence of nitrous and nitric acids in the water that separated from the combustion gas after leaving the compressor. This was overcome by absorbing the acid components in a silica-gel dryer.

The Oberg field is quite similar to the old Venango field in Pennsylvania where repressuring by air was used for many years. In this German field there are at present 29 producing and 19 input wells. Total monthly production is 70 to 90 tons of crude oil; daily production per well ranges from 13 to 80 gallons. The exhaust gas is pumped into the sand at pressures up to 400 psi, and about 88,000 cubic feet of input gas is needed to produce one ton of oil; in Venango the ratio is 105,000 cubic feet to one ton of oil. Since operating with exhaust gas, the reservoir pressure has gradually increased.

It is figured that 11,600 tons of recoverable oil can still be had from this little old field and that recovery of this oil by repressuring with diesel exhaust gas is feasible under present German conditions, particularly if experiments on running the diesel engine on butane fuel instead of diesel oil are successful. Butane is currently cheaper than gasoline or diesel oil and has the further advantage of yielding a greater volume of exhaust gas for the compressor per unit of power.

## British Exhibition, Copenhagen

Stewarts and Lloyds, Limited, with subsidiary and associated companies, exhibited a wide range of products at the recent British Exhibition, Copenhagen. The exhibits displayed the increasing use made of steel tubes in a great many fields including shipbuilding, steam plants and oil fields and refineries.

Dr. Hans G. Kugler

**DR. HANS G. KUGLER,** geologist with many years of service in Trinidad, is now advising geologist to North Venezuelan Petroleum Co., Ltd., and Trinidad Leaseholds, Ltd., with headquarters in Caracas, Venezuela.

Dr. Kugler is a native of Baden, Switzerland, where he obtained his educational training, graduating in 1920 from the University at Basle with a Ph.D. in natural sciences. His first experience in the oil industry was gained in 1914 during seven months exploration work in Trinidad as assistant geologist to Trinidad Leaseholds, Ltd. In 1920 he returned to Trinidad for Apex (Trinidad) Oilfields, Ltd., and until 1925 was instrumental in the development of one of the most lucrative fields in the British Empire. In 1925 he worked temporarily for Trinidad Petroleum Development Company and was responsible for the opening up of the Palo Seco area. From 1925 to 1930 he worked in Venezuela conducting the exploratory work of the North Venezuelan Petroleum Co., Ltd., in eastern Falcon, which led to the development of the Tocuyo oil field and the discovery of Cumarebo field. In 1930 he returned to Trinidad as chief petroleum geologist of Central Mining and Investment Corporation, with which Trinidad Leaseholds Co., Ltd., and North Venezuelan Petroleum Co., Ltd., are affiliated, and attended to exploration in Trinidad, British Guiana, Barbados and the Caribbean region in general. During World War II he assisted the Trinidad government temporarily.

Dr. Kugler has published various papers on the geology of Trinidad and on petroleum geology in general. The latter are the results, in part, of information obtained during visits to oil fields of the United States, Canada and Russia. Last December Dr. Kugler's offices were moved to Caracas.

## New Rheem Plant in Holland

Rheem Manufacturing Company has formed an association with Evenblij Vaten, N. V. of Koog Aan De Zaan near Amsterdam, Holland, to build a steel shipping container factory which will be the most modern in Europe, it was announced by Simon H. Evenblij, chairman of the board. The company is called Rheem Evenblij N. V. The plant is located at Zaandam.

The Holland plant will be the ninth operated by Rheem in company with five associates abroad. It has eleven plants in the United States. Simon H. Evenblij is chairman of the board, and other directors include W. E. Zander, vice president of the American company; A. Lightfoot Walker, general manager, foreign department; I Ingwersen, E. S. Korthals Altes, alternate director for Mr. Zander, and P. W. Van Doome, alternate director for Mr. Walker.

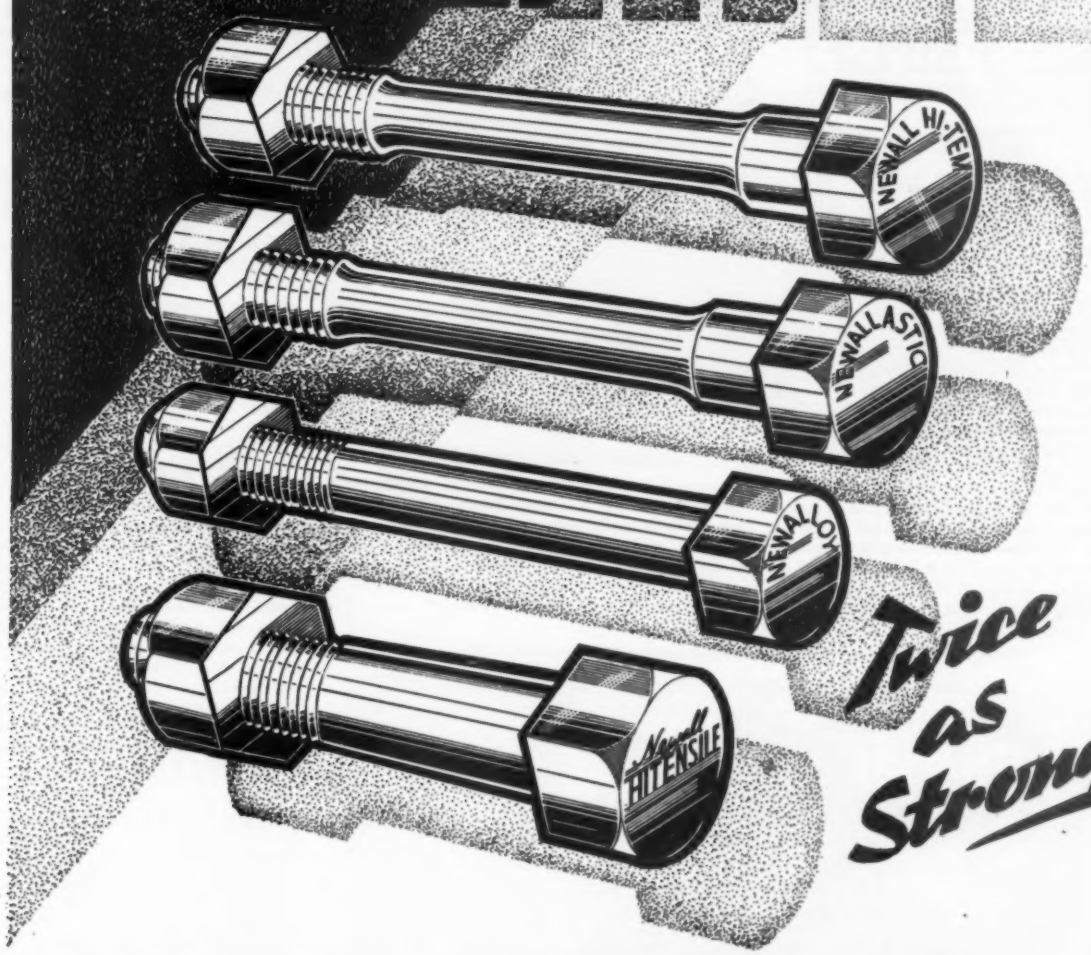
**DR. J. A. TONG,** who has devoted 28 years to the oil business, was appointed general manager of Socony-Vacuum Oil Company of Venezuela, early in February of this year.

By profession Dr. Tong is mining engineer and petroleum geologist. He was graduated from the University of Arizona in 1919; from Oxford, where he enjoyed the honor of being a Rhodes scholar, in 1921; and from Johns Hopkins in 1931. His various positions have never taken him away from the western hemisphere. From 1921-22 Dr. Tong was a member of the management committee for Kern Mex Oilfields, and from 1923-29 he carried out geological studies for the Gulf Oil Company in Venezuela. Thereupon followed the interlude of research studies at Johns Hopkins, and in 1931 he gave a year's service as geologist to the Standard Oil Company of New York.

The year 1933 he spent as consulting geologist and then returned to Venezuela, this time for Socony-Vacuum Oil Company. He was their chief geologist in Venezuela from 1934-40; was manager for their Colombian operations from 1941 until June 1948; and then returned to Venezuela to assume the duties of assistant manager there with headquarters in Caracas. Now, as general manager, he replaces Robert Siegel. Dr. Tong was born in Shasta, California. He served in World War I as air pilot.

Dr. J. A. Tong

# NEWALL

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## New Company to Operate in Mexico

Announcement was made in Mexico City last month of the organization of the Mexican American Independent Company and the conclusion of a contract by which it will undertake exploration and development work in Mexico. The company represents United States capital and the incorporators are Ralph K. Davies, president of American Independent Oil Company, Samuel B. Mosher, president of Signal Oil and Gas Company, and Edwin W. Pauley, independent operator of Los Angeles.

Terms of the agreement between Mexican American and Petroleos Mexicanos, the government-owned Mexican company, as reported, follow the lines of previous proposals which have been discussed with other international companies. Mexican American will carry on exploration and drilling in specified areas and in return will receive the proceeds from 50 percent of the oil obtained from productive wells up to the point where its costs are reimbursed. Thereafter it will be paid 15 percent of the value of production for its services and a slightly higher rate on production from submerged lands. The expense of dry holes will be borne by the operators. Oil produced will be the property of Pemex, but the operators will have the option of taking their share in oil, unless it is needed for domestic use in Mexico.

The contract is to run for a period of 12 years with extension subject to future agreement. First operations are to take place in Vera Cruz and Tabasco in areas selected by the operators with approval of Pemex, which will exercise supervision.

## New Soviet Pipeline

In pursuance of the Soviet policy of substituting gas for coal, wood and oil wherever possible for domestic heating and industrial power, a pipeline to convey gas from Estonian shale mines to the Leningrad district is now being laid and is expected to be in partial operation before the end of the year. The line is 250 kilometers (155 miles) in length and extends from Kokhtla via Yarve to Leningrad. It will serve 275,000 consumers including apartments, schools and hospitals and will effect an estimated saving of three million cubic meters of firewood and 245,000 metric tons of oil per year. One of the Leningrad plants "Lengazapparatura" is beginning the production of gas ranges to supply anticipated installations.

In the Estonian oil shale region, 24 old and new shale mines and cuts are being restored for exploitation, reports the Russian press. New shale refineries are being built, and old and damaged plants reconstructed. The three shale gas plants for supplying Leningrad with heat are expected to be completed by 1950 with some sections scheduled to begin operation this year.

Material and equipment for the shale industry, such as pipes, machinery, technical apparatus and electrical appliances, will be supplied for the most part by the industries of the Leningrad area.

The whole Estonia-Leningrad region is expected to benefit from the shale project through stimulation of industrial construction and road improvement.

## Oil Advertising Resumed in Britain

British petroleum distributing organizations began advertising brands again on October 1 when the voluntary wartime ban on advertising and promotion came to an end. Actual ending of "Pool Petrol" was some months earlier when the Petroleum Board went out of existence and companies were back on a competitive branded product basis. But by agreement the companies in the industry approved a gap to permit the purchase of space and the organization of revived branded trading.

Other promotional work has included the revival of signs at garages and pump stations, the erection of trade marks and other signatures on office doors, all of these having been hidden during the period of the Pool Petrol trading truce. The major companies have all indicated a revival of prewar competitive advertising and promotion, and the companies will undoubtedly get into high as times goes on. Important point is that, despite nationalization tendencies in British industry, the petroleum industry is back on a branded selling basis, with all the old trade marks revived after a gap of nearly nine years.

## Drilling in Tierra Del Fuego

Yacimientos Petroliferos Fiscales started drilling the first oil well in the Argentine district of Tierra del Fuego. As the result of preliminary studies made by exploring commissions, YPF ordered two drilling rigs for the first two wells. The new drilling operations are part of an exploration project aimed at assuring an amply supply of fuel to the country.

Worker is insulating the welded pipe with special pipe wrapping machine.

## Saudi Arabian Production

Crude oil production in Saudi Arabia during February amounted to 14,903,899 barrels, an average of 532,282 barrels per calendar day. Crude oil production for the first two months of 1949 amounted to 31,144,251 barrels, an average of 527,869 barrels per day. Crude processed at the Ras Tanura refinery averaged 149,047 barrels per calendar day in February and 130,125 barrels daily for the two-month period.

## Drilling in Pakistan

The Burmah Oil Co. is drilling a test well at Lakhra in West Pakistan. The well is now down to more than 5,500 feet and is expected to go to a depth of over 12,000 feet for a full test of potential oil-bearing structures. Another deep test well is being drilled at Chakwal, West Punjab, and this has now reached a depth of more than 4,200 feet. Lower part of the well is being directionally drilled at an angle in order to sidetrack obstructions in an abandoned hole in the same location. A new B.O.C. well Chakwal No. 3, is stated to be making good progress, according to reports from Pakistan Concessions Co.

## The New Aramco Discoveries

The Arabian American Oil Co. has completed two new wildcat wells as producers in the past few weeks. The first of these is at Fadhili, some 70 miles northwest of the great Abqaiq field and 20 miles south of Abu Hadriya. The second is at Haradh, which is located 120 miles south of Abqaiq. These two discoveries make up a perfect score for the 1948 Aramco wildcat program which consisted of three wells. The third wildcat was at Ain Dar, some 25 miles west of Abqaiq where good production was discovered about eight months ago.

To date three wells have been completed at Ain Dar, and production tests have been run, showing that the wells in this area are nearly as good as those in the Abqaiq field. This means a MER of around 8,000 barrels per well. Extent of the field is unknown but believed to be of major proportions.

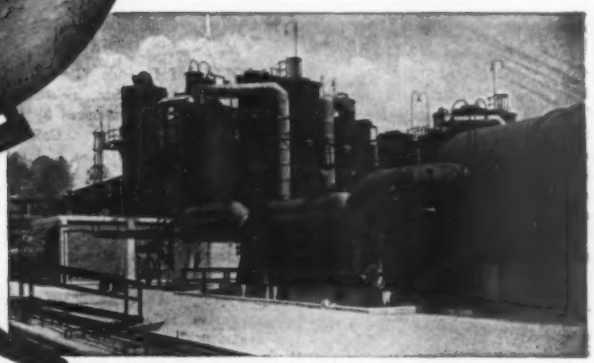
The wildcat at Haradh, representing a step out of 120 miles, is believed to be producing from the D member of the Arab series. This is the same horizon that yields production at both Ain Dar and Abqaiq. The well is rated at about 3,000 barrels per day. The Fadhili well found little or no porosity in the Arab series, and the Abu Hadriya zone was dry. However, a new producing zone was found below the Abu Hadriya, and preliminary tests show that the well will probably be capable of producing around 1,000 barrels per day. The following table summarizes the depths and probable productivity of these wildcat wells comparing them with the averages of the producing field.

| Field | Average Depth-Feet | Average Productivity —B/D |
|---|---|---|
| **Producing fields:** | | |
| Damman | 4,500 | 2,800 |
| Qatif | 7,300 | 2,400 |
| Abqaiq | 6,800 | 12,350 |
| **Wildcats:** | | |
| Ain Dar | 6,900 | 8,000* |
| Haradh | 6,600 | 3,000* |
| Fadhili | 10,000 | 1,600* |

*Estimated on basis of preliminary tests.

The completion of the Haradh well extends to over 200 miles, the area in which production has been found in Arabia. This distance is measured from Abu Hadriya in the north of Haradh in the south. At the end of the year, 88 oil wells had been completed, to which must be added the two new wildcats. Of these 90 wells, 71 are tied in with collecting systems and are in position to produce. Aramco is currently operating seven drilling rigs with which 24 wells were completed in 1948: 18 at Abqaiq, two at Ain Dar and four in Qatif.

# ARUBA
# CALCUTTA
# PHILADELPHIA
# ET CETERA



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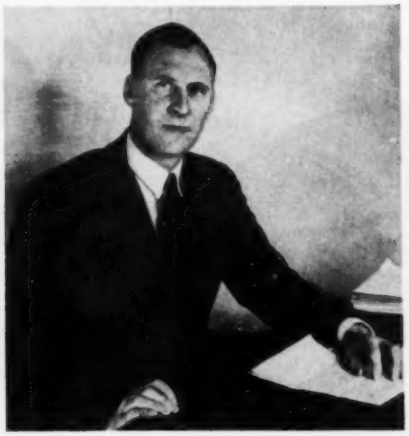
## OIL COMPANY STAFF CHANGES

Hugh C. Tett



C. S. Windebank

**HUGH C. TETT,** managing director of Esso Development Company, Ltd., since 1947, has been appointed to the post of general sales manager of the Anglo-American Oil Company, Ltd. He joined the technical sales department of the company in 1928 and served in various capacities, becoming manager of the department in 1935. In 1939 he transferred to the International Association (Petroleum Industry) Ltd., as assistant to D. A. Shepard, now chairman of Anglo-American, in the coordination of technical sales in Europe for Standard Oil Company (N. J.)

During the war he performed important tasks for the general staff of the British Army and left the service with the rank of Lieutenant Colonel. When the Esso Development Company, Ltd., was formed at the beginning of 1947, Mr. Tett was appointed managing director. He is an active member of the Institute of Petroleum and is a vice president of the Institute's council.

Succeeding to the position vacated by Mr. Tett is C. S. Windebank, whose connection with the oil industry began in 1937 when he joined the technical staff of International Association (Petroleum Industry) Ltd., in London. From 1939 to 1940 he served in the Royal Tank Regiment but was released from the Army in order to undertake technical work on aviation fuels with Esso European Laboratories. On the formation of the Esso Development Company in 1947 Mr. Windebank was made manager of research.

**DR. CHARLES L. SMITH** has been appointed to the staff of the product development department of Ethyl Corp., New York, it is announced, to assist in the development and application of various chemical products. For the past four years Dr. Smith has been technical advisor of the National Agricultural Chemicals Association, Washington, D. C.

**DR. THEODORE W. EVANS** has been appointed director of research for Shell Development Co. He will be in charge of the operation and research program of the company's Emeryville laboratories employing more than 1,000 people, the largest commercial research unit in the west.

Dr. Evans joined the Emeryville staff in 1930 as a research chemist and was active in the early development of alcohols, ethers and esters from refinery cracked gases and in the development of the solvent extraction theory. During the critical rubber shortage his studies led to early supplies of vital synthetic rubber by an exclusive Shell process.

**C. J. COLBY** of Houston, Texas, has joined Kerr-McGee Oil Industries, Inc., as director of purchases and material, it was announced by Dean A. McGee, executive vice president. Mr. Colby will coordinate the purchasing, transportation and materials departments in the company's Oklahoma City headquarters offices. For the past four years he has been manager of machinery sales for Republic Supply Co., Houston. Prior to that time he was with International Derrick and Equipment Co. for 12 years.

**CHARLES M. RIDGWAY,** until recently technical assistant for the refining division of Pure Oil Co., has been named to the new post of manager, research and development laboratories in Chicago.

**H. H. BRERETON** and F. W. Mayer have been appointed vice presidents of two East Coast wholly-owned subsidiaries of the Standard Oil Co. of Calif. Mr. Brereton has been named a vice president of The California Oil Co., and Mr. Mayer has been made a vice president of the California Refining Co. Mr. Brereton, who has been with California Standard and its subsidiaries for 28 years, has been living in the East for the past three years. Mr. Mayer has worked for California Standard and its subsidiaries for 35 years. He has been secretary and treasurer of the California Refining Company since its organization in July 1946.

H. H. Brereton

**C. W. DAWSON** has been appointed chief engineer of the producing department of Standard Oil Co. of California, to succeed the late H. B. Davis. Mr. Dawson has held various engineering positions with the company since 1929.

**W. R. DAVIS** has been named manager of the planning and operations division, manufacturing department, Richfield Oil Co., succeeding the late Milford E. Tracy. Mr. Davis has been superintendent of refineries since 1946.

**RALPH C. FARLEY** has been appointed assistant to the general superintendent of production for Ohio Oil Co. He is succeeded by John S. Leonard, formerly drilling foreman, Reed City, Mich., as district superintendent in direct charge of offshore operations in the Gulf of Mexico. Mr. Farley joined Ohio in 1926. He was advanced to Shreveport division superintendent of production in 1944 and served in this capacity until March 1948, when he was placed in charge of offshore operations.

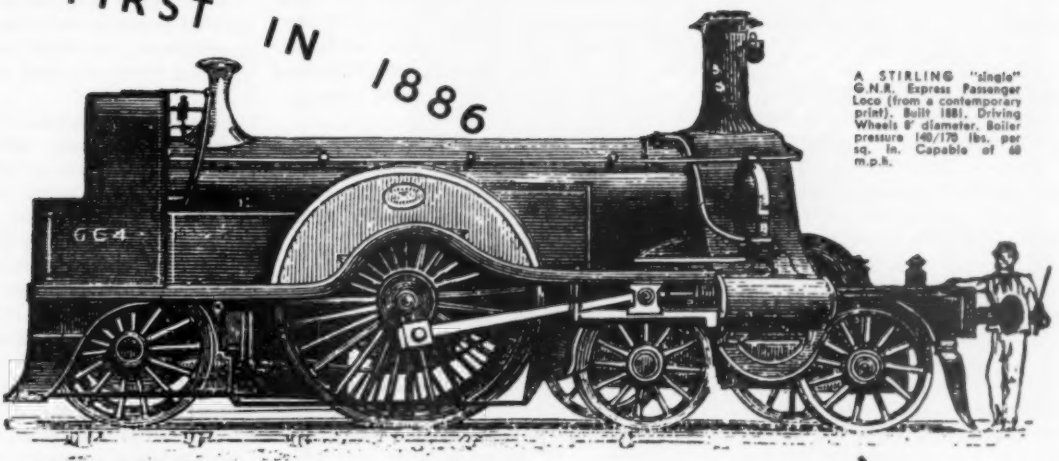
**THOMAS E. SUNDERLAND,** general counsel of Standard Oil Co. (Ind.) has been elected a director of the company. He fills the position on the board vacant since the death of Buell F. Jones, vice president and general counsel, in November 1947. Mr. Sunderland was appointed general counsel of Standard Oil Co. (Ind.) in June 1948. He came to Standard from the position of general counsel of its subsidiary, the Pan American Petroleum and Transport Co., New York.

**A. C. HULTGREN,** traffic manager of Shell Oil Co. for territory east of the Rockies since 1935, has retired after 21 years with the company. He will be succeeded by C. H. Wager who has been assistant manager of the traffic department since 1940. Mr. Wager has been with Shell since 1933. He started as an attorney in the company's Tulsa office, became a general assistant in the president's office in 1937, and in 1939 was transferred to the traffic department. During the war he was assistant director of the supply and transportation division of the Petroleum Administration for War.

**GEORGE B. KITCHEL** of Houston, Texas, has joined Kerr-McGee Oil Industries, Inc., as assistant to Travis M. Kerr, vice president in charge of the drilling department, with headquarters in Oklahoma City. He will be in charge of the company's field operations. For the past seven years Mr. Kitchel has been engineer in charge of the drilling equipment division of Humble Oil and Refining Company. He joined Humble in 1932 as field engineer at Conroe. Except for one year he has been with Humble since that time.

F. W. Mayer

FIRST IN 1886



A STIRLING "single" G.N.R. Express Passenger Loco (from a contemporary print). Built 1881. Driving Wheels 8' diameter. Boiler pressure 140/175 lbs. per sq. in. Capable of 60 m.p.h.

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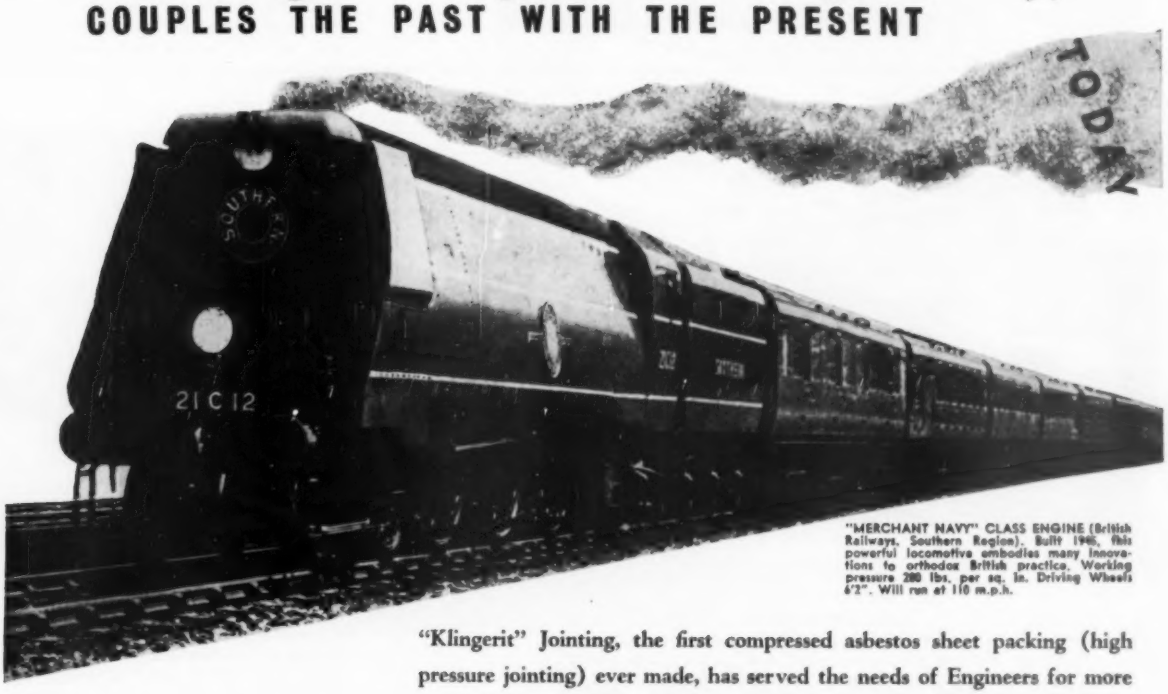

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## World Shipyards Building Larger and Faster Tankers

*(Continued from page 46)*

in the design because the Patagonian oil fields lie in a desolate and remote region. The area is normally accessible only by air.

Measuring 425 feet in length, with a beam of approximately 54 feet and a depth of 31 feet, the "Cazador" and the "Explorador" have a service speed of 12 knots. Their hulls are of welded construction, and their propelling machinery comprises in each case one six-cylinder diesel engine of four-cycle solid injection, direct reversing single acting type, with under-piston pressure induction. The cargo is carried in 24 compartments.

The British Tanker Co., the shipping organization of the Anglo-Iranian Oil Company, has orders outstanding in British shipyards which will add 46 new tankers to its fleet by 1951. These new vessels will raise the company's fleet from the present total of 121 vessels of 1,420,000 deadweight tons to a total of 162 vessels of 2,013,225 deadweight tons. Eventually the company expects to have a fleet of 200 vessels.

At the outbreak of war in 1939 the British Tanker Co. owned 93 tankers of just under one million deadweight tons. Losses during the war were severe, 44 ships or nearly half of the original fleet being destroyed by enemy action. But the recovery has been remarkable, and tonnage quickly reached a figure exceeding the prewar level. This was achieved in October 1946 when Mrs. Winston Churchill christened the 12,412-ton M. V. "British Baron" at the Birkenhead yards of Messrs. Cammell Laird and Company.

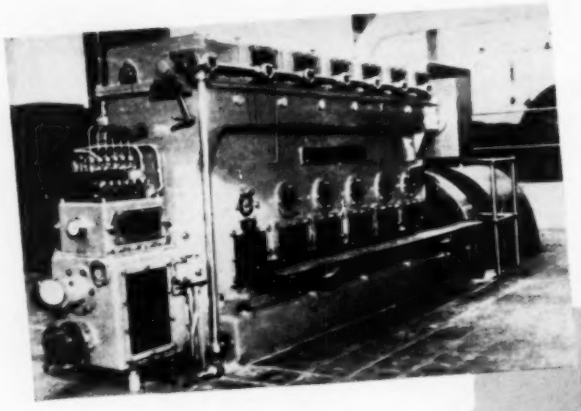
During 1948 the company took delivery of 12 new tankers. The current building program calls for the delivery of 15 tankers, aggregating 191,150 tons in 1949 and 22 tankers aggregating 253,900 tons in 1950.

The motor tanker "British Chivalry" recently ran her trials on the Clyde after being launched by the Blythswood Shipbuilding Co., Ltd. The "British Chivalry" is the halfway design between the earlier 12,000 to 12,500 ton tankers and the new class of six tankers, designed to go into service in 1951 and each carrying 23,000 tons. The "British Chivalry" and others in her class carry 16,150 tons deadweight, are 515 feet long, have 27 main tanks and two large pumprooms, each with two steam-driven oil cargo pumps with a discharge capacity of 500 tons each per hour. This is the largest tanker built by Blythswood as yet and also the largest built for the British Tanker Co., Ltd.

On Sept. 16 last Her Royal Highness Princess Margaret christened the "British Mariner" at the Govan shipyards of Harland and Wolff, which has orders for seven other ships to be built for the same owners. The new tanker, which now is in service, has a deadweight of 12,300 tons. It is driven by a six-cylinder, single acting, four-stroke diesel engine.

The British Tanker Co. has a fleet of 121 vessels and a seagoing personnel of more than 5,000. At the close of 1948 British yards were building 37 additional tankers for this company. Present plans are that British oil companies shall double their 1947 business by 1953. This program requires the construction of a large number of additional tankers to bring in crude to British plants and carry refined products to market. Many of these ships are of the 12,500-DWT class designed for economical operation and quick turnaround in port.

Construction of oil barges for inland waterways in the United States and the intercoastal barge canal was active throughout 1948, and this situation is expected to continue this year also. On February 1 there were 56 oil barges under construction at United States yards. The industry is making greater use of the 6,000 miles of inland waterways for the transportation of both crude oil and refined products. In large tows

*For Irrigation in the Sudan*

The illustration shows a Crossley 300 B.H.P. four stroke, four cycle Diesel engine installed in the Sudan for irrigation purposes at a large pedigree cattle farm.

The engine drives a 24" centrifugal pump delivering 20,000 gallons of water per minute against a 30 feet head.

**Crossley engine types for various applications range from 10 to 3000 B.H.P.**

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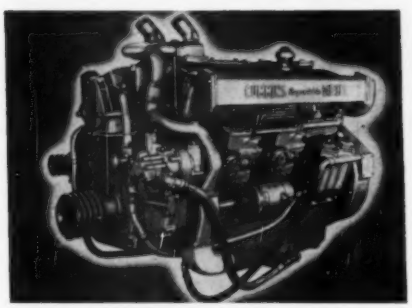
the new type barges are providing transportation at costs even below those of the pipelines in some instances.

Oil refiners with plants in the Ohio River valley are bringing crude oil to their stills from Corpus Christi and distributing refined products over a considerable area.

There have been important changes in design of barges and towboats. Integrated barges with combinations of square-end and conventional barges have been developed to increase maneuverability and reduce power requirements. Towboats are being equipped with Kort nozzles to provide more thrust per rated horsepower, hull designs are being changed to more efficient types, and rudders have been improved. Main engines often are controlled from the pilot house, and boats are equipped with radar and ship-to-shore telephones. Among the most active yards are Avondale Marine Ways of Westwego, La.; Dravo Corp., Pittsburgh; and Ingalls Shipbuilding Corp., Decatur, Ala.

## Rapid Business Trip

Frank Kenyon, of Wm. Kenyon & Sons, Ltd., made a flying trip from London to New York early in March to conclude a contract in behalf of Wm. Kenyon & Sons (America) Ltd., for the heat insulating equipment of a large South American refinery now under construction. The entire time spent on the journey including conclusion of the transaction in New York was 68 hours.

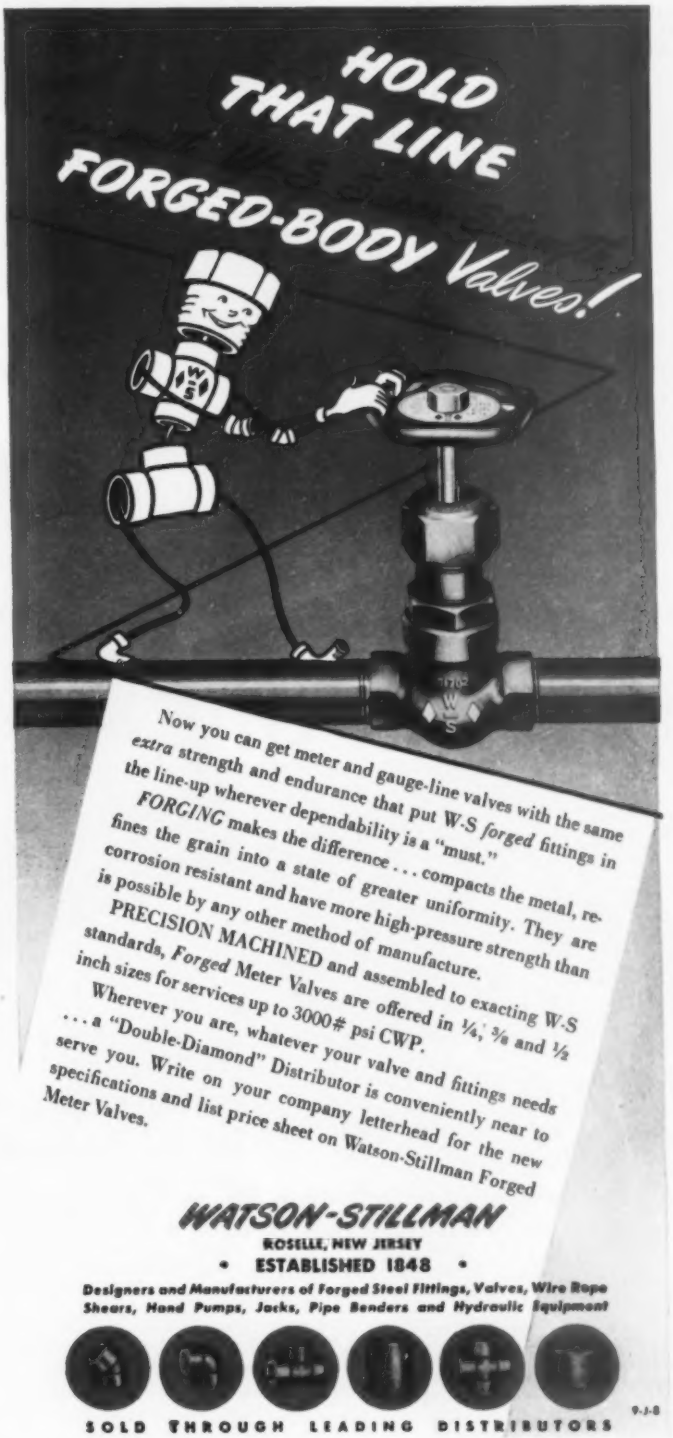


## New High-Speed Diesel

Cummins Engine Co., Inc., unveiled a new high-speed diesel engine at its factory at Columbus, Ind., recently. The new model furnished more power than any high-speed diesel now in production. The 12-cylinder, V-type, supercharged engine has a maximum rating of 550 hp. at 2,100 rpm. The manufacturers have developed the engine particularly for applications such as drilling, where power requirements are growing with the larger rigs for deeper drilling and where it is not feasible to extend compounding indefinitely. Mid-Continent Supply Co. and Mid-Continent Cummins Export Corp. sell and service the new unit in the petroleum industry.

## Pipeline Contract Awarded

The H. C. Price Co. has been awarded a contract totaling approximately $8 million for construction of three sections of 26-inch high-pressure natural gas transmission line in the Appalachian Mountain area for Atlantic Seaboard Corp. and Virginia Gas Transmission Corp. The three sections include two hundred miles of line.



HOLD THAT LINE
FORGED-BODY Valves!
Now you can get meter and gauge-line valves with the same extra strength and endurance that put W-S forged fittings in the line-up wherever dependability is a "must."
FORGING makes the difference . . . compacts the metal, refines the grain into a state of greater uniformity. They are corrosion resistant and have more high-pressure strength than is possible by any other method of manufacture.
PRECISION MACHINED and assembled to exacting W-S standards, Forged Meter Valves are offered in ¼, ⅜ and ½ inch sizes for services up to 3000# psi CWP.
Wherever you are, whatever your valve and fittings needs . . . a "Double-Diamond" Distributor is conveniently near to serve you. Write on your company letterhead for the new specifications and list price sheet on Watson-Stillman Forged Meter Valves.
WATSON-STILLMAN
ROSELLE, NEW JERSEY
• ESTABLISHED 1848 •
Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment
SOLD THROUGH LEADING DISTRIBUTORS

## Advertising Experiment

Austin, Nichols & Co., Inc., New York, is conducting an interesting advertising experiment in this issue of WORLD PETROLEUM. The company is using a half page to promote the sale of "America's most expensive whiskey" to oil men. Heretofore the company has used newspapers and magazines of general circulation rather than a magazine circulated in an individual industry such as WORLD PETROLEUM. The "most expensive" whiskey is 101 proof, eight-year-old rye or bourbon bearing the trade name "Wild Turkey." It is not available everywhere but Austin Nichols will arrange delivery through local dealers.

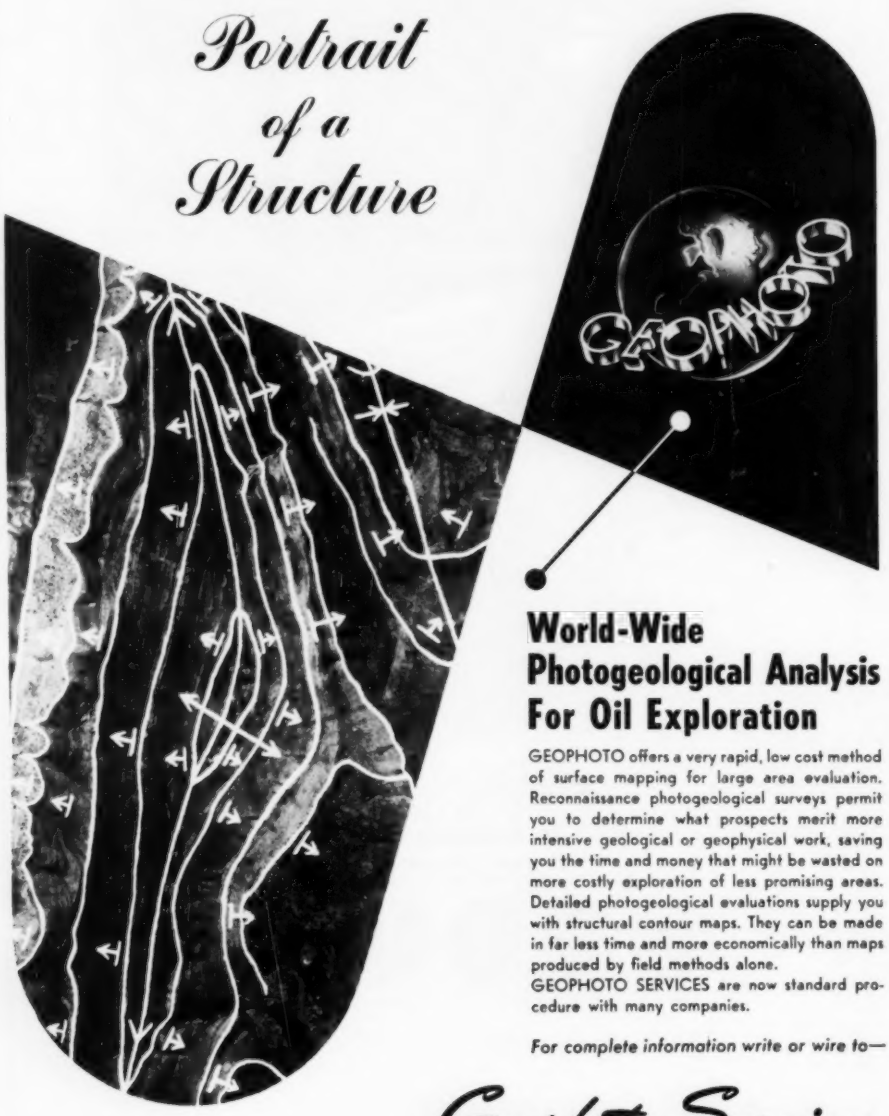
## Du Pont Chemists Promoted

The DuPont Co. has promoted Afton D. Puckett to the position of district laboratory coordinator in the petroleum chemicals division and appointed John N. C. Cameron as manager of the division's Gulf Coast district laboratory, Houston, Texas. The division markets tetraethyl lead antiknock compounds and petroleum additives. Mr. Puckett formerly was in charge of studies of antiknock properties of motor fuels in DuPont's combustion engineering laboratory at Deepwater Point, N. J. In his new position he will coordinate technical services extended by DuPont through five district laboratories to the oil refining industry of the entire country in connection with its use of tetraethyl lead and other petroleum chemicals.

## Forms New Process Design Company

A new company, called the Rust Process Design Co., has been formed to take over activities of the process engineering division of The Rust Engineering Co., Pittsburgh. Rust is currently handling the design and construction of two 25,000-barrel-per-day crude oil topping units for Petrol Refining, Inc., at Texas City, Texas.


*Portrait of a Structure*




**World-Wide Photogeological Analysis For Oil Exploration**

GEOPHOTO offers a very rapid, low cost method of surface mapping for large area evaluation. Reconnaissance photogeological surveys permit you to determine what prospects merit more intensive geological or geophysical work, saving you the time and money that might be wasted on more costly exploration of less promising areas. Detailed photogeological evaluations supply you with structural contour maps. They can be made in far less time and more economically than maps produced by field methods alone.
GEOPHOTO SERVICES are now standard procedure with many companies.

*For complete information write or wire to—*

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## Appoints Sales Engineer

Aeroquip Sales & Engineering, Inc., Fort Worth, Texas, has appointed Tom Austin as sales engineer in Missouri, Kansas, Nebraska and Colorado. His headquarters are in the Land Bank Building, Kansas City, Missouri.

## Hydrofluoric Acid, Versatile Chemical Agent

One of the significant developments in the oil refining industry during the late war was the application of anhydrous hydrofluoric acid as a catalyst in the production of high quality gasolines, which was accomplished by it much better than is done by the older methods of sulfuric acid alkylation. But hydrofluoric acid is an exceedingly active substance which must be handled very understandingly.

Information on the use and handling of hydrofluoric acid has been brought together and systematized in a brochure of 35 large pages issued by Harshaw Chemical Co., entitled, "Hydrofluoric Acid Anhydrous." Except for the first page, this is not a sales talk. The subject of materials of construction suitable for this reagent, its handling (with precautions,) sampling, analysis and storage are set forth in ample detail, with helpful diagrams and illustrations. There is also a succinct description of alkylation processes in the oil refinery, and the use of hydrofluoric acid as a condensing and fluorinating agent for the preparation of many important petroleum derivatives. This brochure should be well received in the laboratories of refineries where high quality gasoline and petrochemicals are made. Copies are available on request to the company at 1945 East 97th Street, Cleveland 6, Ohio.

## Halliburton to Use Hydrafrac Process

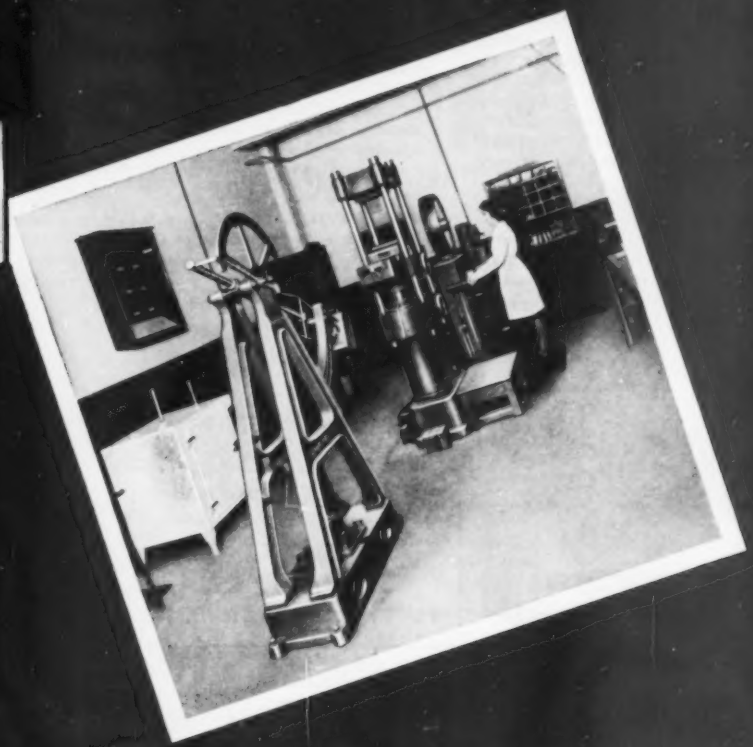
Sanolind Oil and Gas Co. has licensed the Halliburton Oil Well Cementing Co., of Duncan, Okla., to service wells with the Hydrafrac process developed by Stanolind. The process is designed to increase oil or gas production by fracturing the productive formations, thus making it easier for oil or gas to flow through the formations to the wells. Description of the process was published in the November 1948 issue of WORLD PETROLEUM. Halliburton has an exclusive license for at least two years and the right to license operators in certain foreign countries to use the process on a commercial basis.

## Lion To Build Chemical Plants

Lion Oil Co., El Dorado, Ark., has signed construction contracts for a sulfuric acid plant and an ammonium sulfate plant to cost $2,000,000. Tentative completion dates for both projects are September, 1949. The sulfuric acid plant will produce 300 tons per day. The ammonium sulfate plant will produce a total of 380 tons a day of commercial grade ammonium sulfate.

## Oil Storage Tank Roof

The Chicago Bridge and Iron Company, Chicago, Ill., has published a four-page leaflet, "The Vapordome Roof," which describes the use of a vapordome roof on a flat-bottom oil storage tank to prevent evaporation losses caused by daily breathing. A cutaway view of a tank with a vapordome roof shows the flexible membrane in the dome at the center of the roof. The membrane moves up and down as vapor in the tank expands and contracts, due to temperature changes. This prevents daily loss of vapor through the vents. The leaflet also includes a table of standard Vapordome roof sizes. A copy will be sent on request to Chicago Bridge and Iron Company, 332 South Michigan Ave., Chicago 4, Ill.



Stretched till it breaks ...

to check the Excellence of Quasi-Arc Electrodes

Quasi-Arc

REG. TRADE MARK

THE WORLD'S FINEST ARC WELDING ELECTRODES & EQUIPMENT

## Radiotelephone System for Pipeline

The first microwave radiotelephone and communications system to be used in the petroleum radio service will be set up by the Keystone Pipe Line Co., a wholly owned subsidiary of The Atlantic Refining Co. The Federal Communications Commission has authorized the installation of the first five stations of the system, which eventually is expected to extend through Pennsylvania, New York and Ohio and will cost approximately $1,500,000, provided the initial facilities prove successful.

The Keystone Company will construct the five stations, serving the pipeline for a distance of some 75 airline miles, which are expected to cost about $250,000. Strictly a fixed station system, the terminal, intermediate and automatic relay facilities will operate on frequencies of 1860, 1910 and 1960 megacycles. The Federal Telephone & Radio Corp. and Federal Telecommunication Laboratories engineered the project for Keystone in cooperation with J. D. Munton, manager of the communications department of the Atlantic Refining Co. and its subsidiaries. He pioneered in 1934 very high frequency shore to ship radiotelephone service with tugs owned by Atlantic operating off Philadelphia and the use of selective signaling telephone and carrier equipment for the southwestern petroleum operations of Atlantic.

**MISS HETTIE M. DAWES** has been appointed comptroller of Avondale Marine Ways, Inc., to succeed Henry Z. Carter, who recently was promoted to general manager. Miss Dawes first joined Avondale in August 1942 as an assistant bookkeeper.

Roy E. Jones

## Link-Belt Export Manager

Link-Belt Company announces that Roy E. Jones has been appointed export manager of the company, with headquarters in New York. He succeeds Carl A. Woerwag, who is retiring from active service because of ill health. Mr. Jones, a graduate of the University of Pennsylvania, started his business career at Link-Belt's Philadelphia plant in 1927. He has worked on export sales since 1941 and was made assistant export manager in 1944.

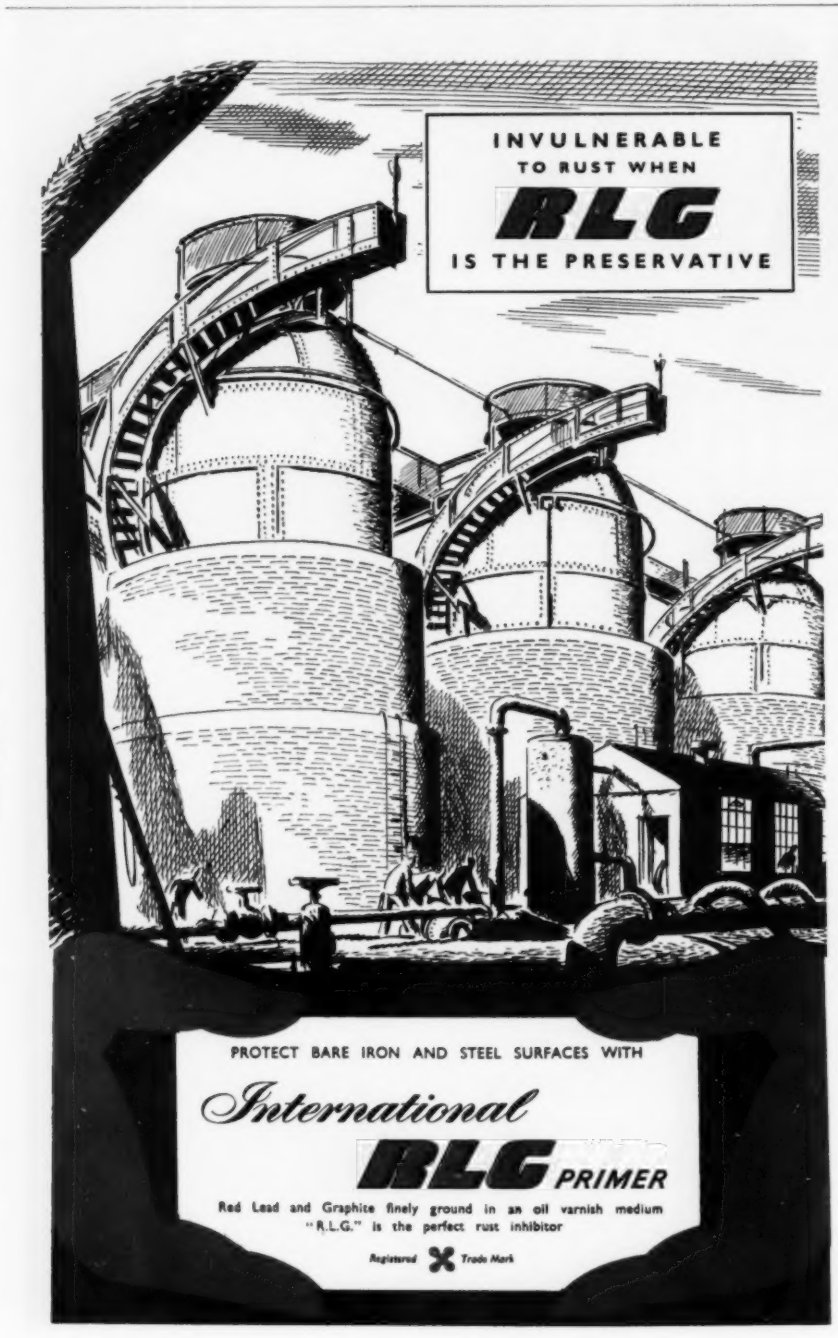
## Law of Oil and Gas Conservation

The Mineral Law section of the American Bar Association has issued a book of 754 pages entitled, "Conservation of Oil and Gas, a Legal History," which to all appearances contains a full digest of past and present laws having to do with oil and gas from the conservation standpoint. To produce the book the Bar Association appointed an editorial committee of five who enlisted a corps of legal experts in each of the states, 35 in number, that have enacted legislation of one sort or another for the conservation of petroleum resources.

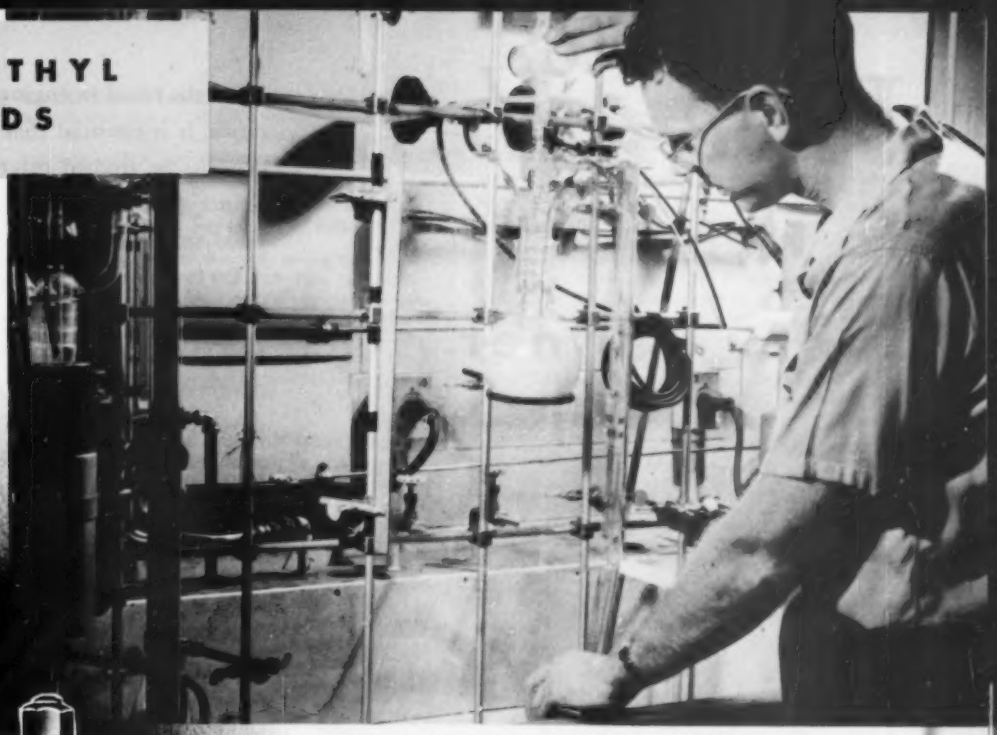
The law on oil and gas conservation is treated under four general heads. Fundamentals of reservoir behavior relating to conservation; legislative, administrative and judicial concepts of oil and gas conservation as applied within the states; the Interstate Compact to conserve oil and the Interstate Oil Compact Commission; and the national government's part in the conservation of oil and gas. The editors have not attempted to produce a text book nor a technical treatise of the regulation of oil and gas production, but a handbook that will be used by attorneys, administrator, judges and citizens who want to know about preserving petroleum resources. A valuable feature of the book is an overall treatment for the first time of the many national governmental agencies that participate in the control and operation of federally owned oil lands. The book is distributed by American Bar Association, 1140 North Dearborn Street, Chicago; $3.00.

## Seismograph Opens Denver Offices

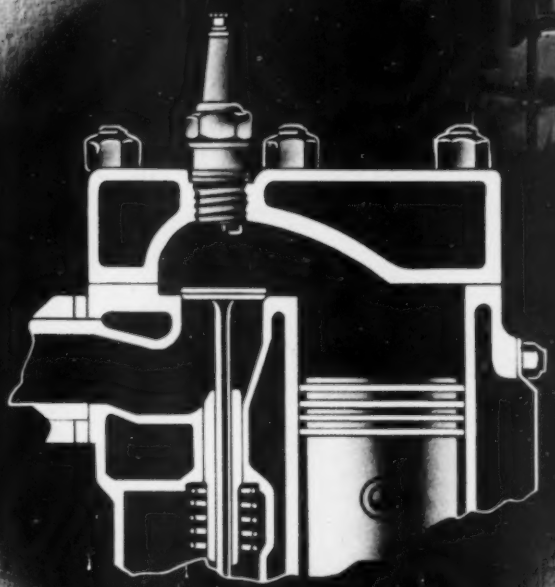
Carl W. Blakey has been appointed manager of the Seismograph Service Corporation's newly created Rocky Mountain division with offices located in Denver, Col. Mr. Blakey joined Seismograph Service in 1936. In 1937 he was promoted to party chief and placed in charge of a crew operating in Persia, where he remained until his return to the United States in 1939. In 1945 Mr. Blakey was placed in charge of a crew operating in Iraq and a few months later was promoted to manager of the company's Middle East operations with headquarters in Cairo, Egypt, where he lived until his return to this country in March, 1948.

**DU PONT TETRAETHYL LEAD COMPOUNDS**



The chemical laboratory contributes much helpful data on these investigations. Here, rates of sublimation are being measured in connection with combustion chamber deposit studies.



# *Du Pont Research*

## At Work on the Problem of Engine Deposits

Du Pont research on tetraethyl lead and other anti-knock agents is aimed at improving fuel performance and fuel utilization. A vital phase of this research is learning more about how fuels behave inside the combustion chamber. One such basic study is devoted to an investigation of engine deposits.

Although much work has been done on this subject, there is still a great deal to learn about the factors affecting deposit formation, as well as the mechanism by which these deposits affect combustion.

Fuels, lubricants, design, operation—these and other variables which can affect deposits are all being investigated, working toward reduction of deposit formation. This is another example of Du Pont research working on problems of interest to every refiner—research to help you create better fuels, for today and for the future.

Engine parts are carefully examined after each test.

DU PONT
REG. U. S. PAT. OFF.

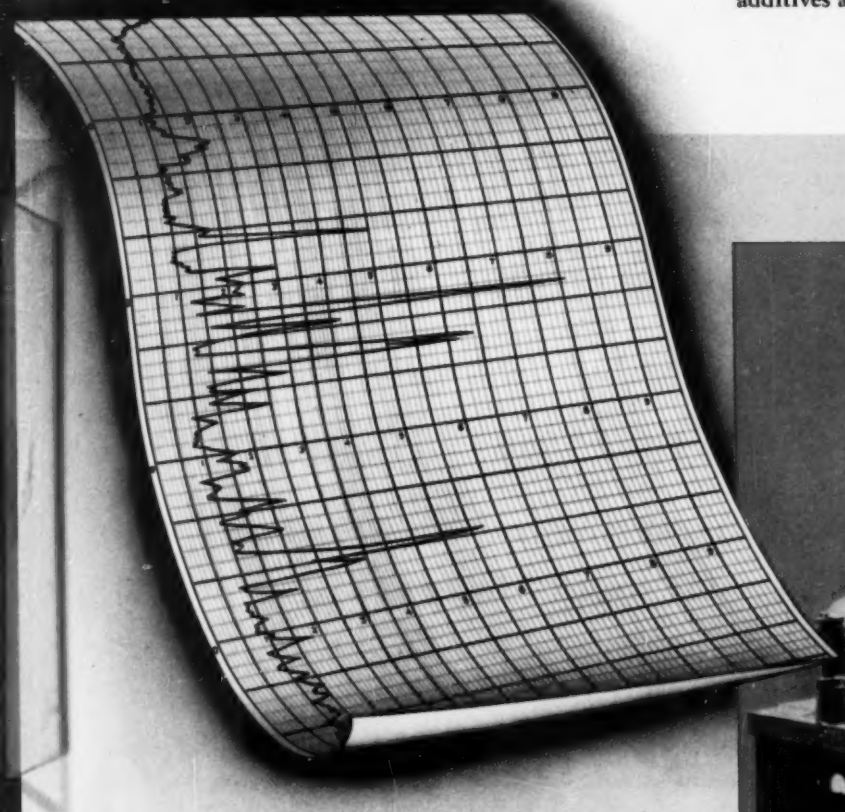
**Better Things for Better Living . . . *Through Chemistry***

# *Research...*

## To Help Every Refiner

With the trend in engine design toward higher compression ratios, it is essential that the effects of combustion chamber deposits be studied carefully. This problem concerns every refiner because it has an important bearing on meeting and satisfying the motorist's needs.

Du Pont chemists, engineers, and physicists are at work investigating the many variables that can affect deposit formation, as well as the effect of these deposits on engine parts and operation. In this and other research projects, Du Pont is developing information on problems of interest to every refiner, information which will also contribute to improved additives and fuels—today and in the future.



The X-ray spectrometer is used to give quick, accurate analyses of engine deposits.

**MAKE DU PONT THE SOURCE FOR ALL OF YOUR GASOLINE ADDITIVES . . .**

*Tetraethyl Lead Compounds*
*Motor Mix—Aviation Mix*
*Antioxidants*
*Metal Deactivator — Dyes*

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**PETROLEUM CHEMICALS DIVISION**
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*Laboratories:* Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · El Monte, Calif.

*District Offices:* Wilmington, Del. · Chicago, Ill. · Tulsa, Okla. · Houston, Texas · Los Angeles, Calif.

Henry Z. Carter

## Carter is Avondale Manager

The appointment of Henry Z. Carter as general manager of Avondale Marine Ways, Inc., was announced recently by James H. Bull, president of the large New Orleans shipyard. Mr. Carter has long been associated in the marine field, having served many years with the U. S. Maritime Commission in charge of the construction audits throughout the United States.

## Director of Slick Research

Dr. Harold Vagtborg, of Kansas City, has accepted an appointment as director of Southwest Research Institute and the Institute of Inventive Research and as technical director of the 3,500-acre Essar Ranch near San Antonio. These are all foundations established by the late Tom B. Slick and maintained under the direction of Tom B. Slick, Jr.

## Pioneer Geologist Passes

Bailey Willis, dean of American geologists and pioneer in the advancement of geological theory and practice, died at his home near Stanford University, California, in February last at the age of 92. His professional career spanned a period of 70 years and included work as explorer, teacher, public servant and consultant to scientific bodies and foreign governments.

A graduate of Columbia School of Mines in 1879 his first professional work was done as geologist for a group of western railroads. In 1884 he joined the United States Geological Survey and served as assistant director from 1897 to 1902. In succeeding years he directed exploration in China and conducted studies in Europe under the auspices of the Carnegie Institution, was consulting geologist to the Minister of Public Works in Argentina and carried on investigations of Latin American resources for the United States government. From 1915 to 1922 he was professor of geology at Stanford University and since then had held the title of professor emeritus. In later years he had directed studies in world seismology for the Carnegie Institution in South America, the Middle East, the Orient and Australasia.

Mr. Willis was active in association work and had been president of the Seismological Society of America and the Geological Society of America. He represented the United States at many international meetings and had received honorary degrees, medals and decorations from European institutions and governments. His thinking along original lines made his work as teacher and lecturer particularly stimulating to all those who came in contact with him.

## Gallonage Calculator

C. M. Deets, traffic manager of Pennsylvania Refining Co., Butler, Pa., has developed a simple calculator which quickly and easily corrects gallonages to net gallons @ 60°F. The "Galculator" is constructed of a 4¼ by 9½-inch plastic jacket holding a heavy cardboard calibrated slide which extends beyond both ends for easy operation and covers the API gravity range from 15 to 78.9° (.6725 to .9659 Sp. Gr.). Temperature range is from 20 to 120°F. Copies of the calculator are available by writing direct to Pennsylvania Refining Company, 2686 Lisbon Rroad, Cleveland 4, Ohio. Enclose $1 for each to cover cost of manufacture, mailing and handling.

## Visits California

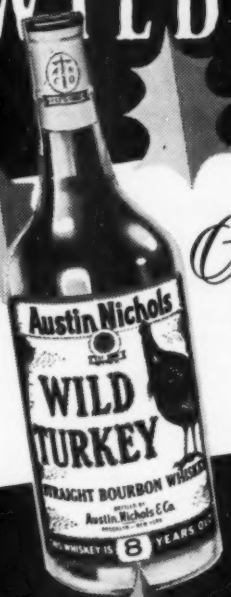
Edgar "E. C." Johnston, prominent Texas oil producer, contractor and partner in the Johnston Enterprises, Longview, Texas, has made a trip to Hydra-Line's California establishment at Los Angeles to watch shop and field testing of the Hydra-Line MD-975. Accompanying Edgar are his financial manager, Link Martin, his drilling superintendent, Ray Bedingfield, and his son, Glenn Johnston, who is one of the owners of Johnston Enterprises. Another interested spectator at the Hydra-Line tests is "Foots" Johnston, of Shreveport, service manager of the Tri-State area for Johnston Oil Field Service Corp.


EXCLUSIVE ADVERTISEMENT — —

WILD TURKEY

STRAIGHT BOURBON
STRAIGHT RYE

America's Rarest Gift Whiskey




For the appreciation of the true connoisseur.

Austin Nichols & Co. Inc. BROOKLYN—NEW YORK

101 PROOF

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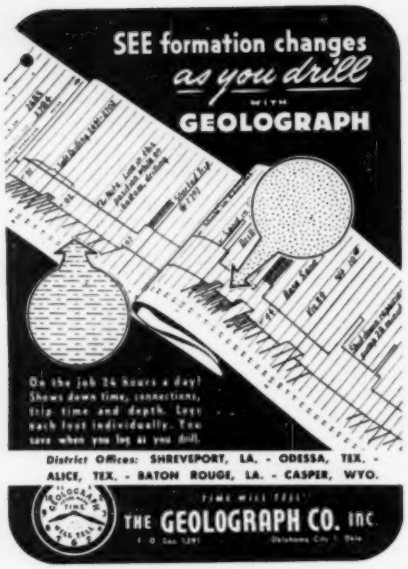
This Advertisement is directed to gentlemen in the petroleum industry who may be interested in an American whiskey of unsurpassed quality—

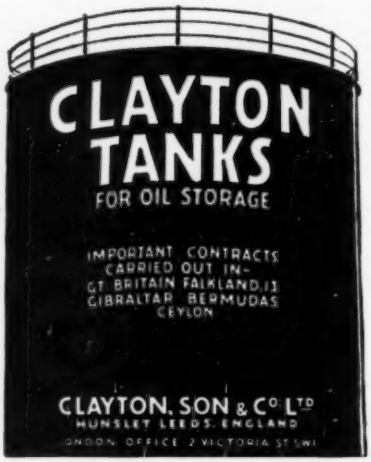
Wild Turkey Straight Bourbon and Wild Turkey Straight Rye are instantly recognized for what they are: *the unqualified finest* whiskies of their type. Your guests will tell you so.

As America's rarest whiskey, Wild Turkey *may* not be on hand at your nearest package store. However, you will find it worth your while to write us to arrange case delivery through the usual licensed channels.

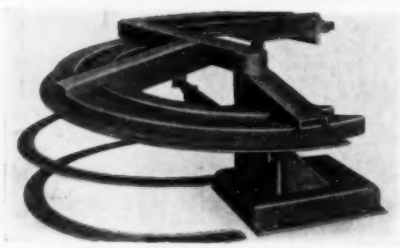
For an immediate reply—write attention MR. N. O. CARR, c/o Austin, Nichols, 184 Kent Ave., Brooklyn 11, New York.

8 YEARS OLD—101 PROOF—Straight RYE or BOURBON


SEE formation changes
as you drill
WITH
GEOLOGRAPH
On the job 24 hours a day!
Shows down time, connections,
trip time and depth. Sets
each foot individually. You
save when you log as you drill.
District Offices: SHREVEPORT, LA. - ODESSA, TEX. -
ALICE, TEX. - BATON ROUGE, LA. - CASPER, WYO.
TIME WILL TELL!
THE GEOLOGRAPH CO. INC.




Another IRVINGTON JOB



Repeater for continuous wire drawing mill.

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STEEL & IRON WORKS
Established 1909
NEW BRUNSWICK, N. J.
• Engineers • Fabricators • Erectors •
Inquiries Invited

Captain Douglas Bader

## 20,000-Mile Air Inspection Trip

A striking demonstration of the practical value of the airplane in oil industry operations was provided by a recent trip by Group Captain Douglas Bader, a senior officer of Shell's aviation department, in a flight from London to the Far East and back. Flying a single-engined British Proctor plane, Captain Bader covered 20,000 miles in 152 flying hours and en route made 25 stops to visit company installations. The primary purpose of his trip was to arrange for aerial communication service in Dutch New Guinea and Indonesia, but he also visited stations in France, Italy, Greece, Cyprus, India, Malaya and Pakistan.

## Photometer Controls Malodorant

A General Electric x-ray photometer, originally designed to measure the tetraethyl lead content of gasoline, now is being used to control the amount of malodorant introduced into natural gas. The instrument operates by measuring the extent to which a test material absorbs a beam of x-rays. By comparison with materials for which the absorption rate is shown, the instrument determines the quantity of any material mixed with another material of different atomic weight.

## New Research Center

Stanolind Oil and Gas Company will soon begin the construction of a new and larger research center at Tulsa. A 60-acre site in southeast Tulsa has been purchased, and construction will begin the latter part of the year. The new center is expected to be ready for use early in 1950. The company will retain its present buildings at 1136 North Lewis for the manufacture of field geophysical equipment and for testing and analytical work. When the new laboratory is completed, there will be approximately 600 people at the new site and about 100 at the present one, making a total staff of nearly 700. This is compared to a current employment of approximately 500.

**W. S. AULT,** chief technical adviser of Shell-Mex and B. P., Ltd., has been appointed chief chemist of Shell and Anglo-Saxon Petroleum Companies. He will take up this appointment on his return from the United States where he has gone on a three month visit. He succeeds J. A. Oriel who will continue to be general manager of the "Shell" Refining and Marketing Co. Mr. Ault spent five years at Suez with Anglo-Egyptian Oilfields, Ltd., returning to the United Kingdom in 1944. After more than two years at Stanlow, where he was assistant refinery manager, he went to Shell-Mex and B. P., Ltd., as chief technical adviser in September, 1946.

## W. G. Lane Dies

Wilfred G. Lane, one of the founders of Lane-Wells Co., died March 3, 1949, in Los Angeles. He had not been active in the company since 1938, but together with Walter T. Wells (now chairman of the board) organized the technical oil field service business to develop the gun perforator.

**R. A. ANDRESEN** has been appointed assistant chief engineer of the manufacturing department, eastern division of California Texas Oil Co., Ltd. Mr. Andresen, with headquarters in New York, will handle all refinery engineering and construction projects east of Suez and in the eastern Mediterranean. After taking a BS degree in mechanical engineering at the University of California in 1935, Mr. Andresen joined the general engineering department of Standard Oil of California as a process engineer. From 1938 to 1948 he spent the majority of his time on Bahrein Island as chief engineer of the Caltex refinery there, in charge of engineering, maintenance, construction and transportation.


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6' x 3.5'
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Oil Directory & Handbook on Colombian Oil

Complete personal list of 36 principal oil operators and 125 affiliated oil enterprises; maps; cost of wildcatting data; list of concessions; private oil lands; etc. 115 pp. loose-leaf; letter size. $35/copy.

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Colombian Oil-News Digest
&
Colombian Wildcat News

Weekly scout letter covering political, economic and wildcat developments.

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Colombian Oil Statistics

Monthly data on all operations; producing; refining; exports; prices; drilling; consumption; imports oil products; etc. etc.

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## *now available*

Angus Cups—the first high-grade Valve and Seating Cups of British manufacture—are now available to Oil Field Engineers. Produced from "Gaco" Fabric composition, an extremely tough and wear-resisting compound, with our famous "Gaco" synthetic rubber as the bonding medium.

Layers of fabric are impregnated with "Gaco" and moulded under heavy pressure to form a tough compact composition capable of resisting the action of abrasion, crude oils and gases at high working pressures and temperatures.

Years of intensive research are behind the development of Angus Cups. Supplied in three hardnesses, sizes as laid down by A.P.I. standards.

★

*Our "Gaco" synthetic material, which achieved a wide reputation before and during the late war as a medium for hydraulic sealing in aircraft and engineering mechanisms, is also now available for the manufacture of other products used in the Oil Industry.*

ANGUS GACO CUPS

GEORGE ANGUS & Co LTD

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Manufacturers
*Oil Seal Works*
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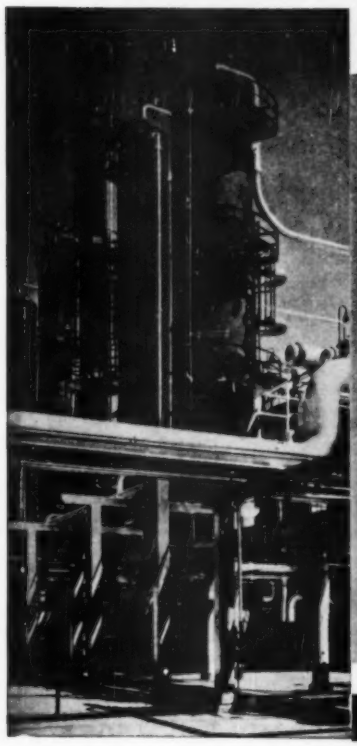
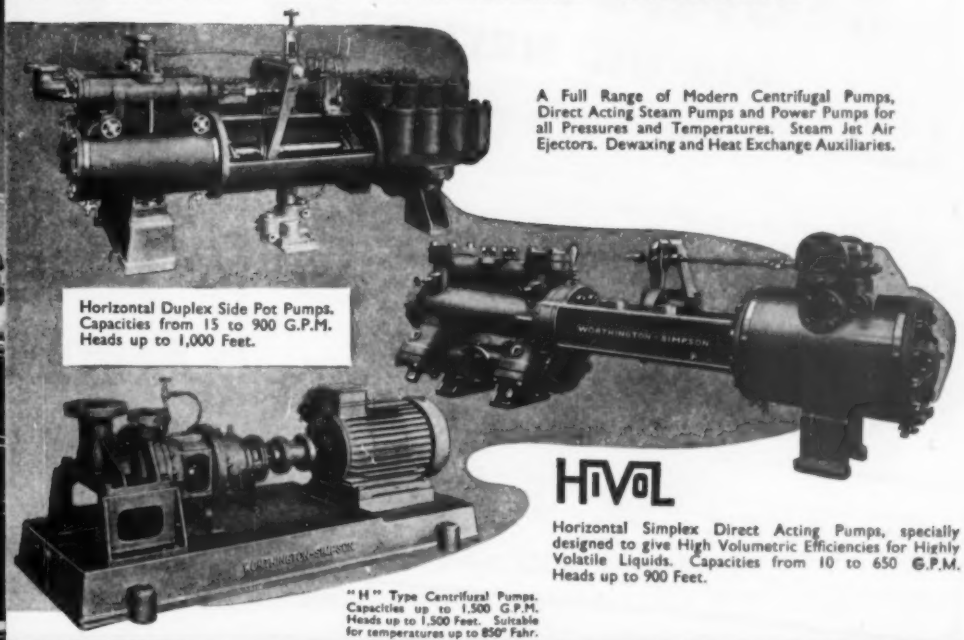
AGENTS THROUGHOUT THE WORLD

# WORTHINGTON-SIMPSON

## PUMPS *FOR REFINERY SERVICE*





A Full Range of Modern Centrifugal Pumps, Direct Acting Steam Pumps and Power Pumps for all Pressures and Temperatures. Steam Jet Air Ejectors. Dewaxing and Heat Exchange Auxiliaries.

Horizontal Duplex Side Pot Pumps. Capacities from 15 to 900 G.P.M. Heads up to 1,000 Feet.

"H" Type Centrifugal Pumps. Capacities up to 1,500 G.P.M. Heads up to 1,500 Feet. Suitable for temperatures up to 850° Fahr.

HIVOL

Horizontal Simplex Direct Acting Pumps, specially designed to give High Volumetric Efficiencies for Highly Volatile Liquids. Capacities from 10 to 650 G.P.M. Heads up to 900 Feet.

WORTHINGTON - SIMPSON LTD. NEWARK-ON-TRENT

## New Store Opened

Ken W. Davis, president and general manager of Mid-Continent Supply Co., Fort Worth, has announced the personnel for a new store at Duncan, Oklahoma. J. H. Mackey, formerly at Eunice, is manager. Field salesmen were W. E. Levell, formerly at Gainesville, and Bill Thornton, formerly at the Sundown store. Other personnel includes B. J. Hickman and H. V. Harris. The store is under the supervision of N. W. Dail, district manager at Wichita Falls.

## Ship Cleaning with Black Light

"Black light" is being used in the cleaning of cargo tanks in tank steamers. Because of its strong fluorescent qualities, fuel oil glows under "black light," thus making it easy to locate and remove final traces of oil where a thorough cleaning job must be done.

## To Build Gas Cleaning Plant

Panhandle Producing Co., San Antonio, Texas, will erect an automatic Desulfo plant near Stinnet, Texas, to remove $H_2S$ from 2,270,000 cubic feet of gas daily. The plant is being manufactured by Stacey-Dresser Engineering Division of Dresser Industries.

## Oil Industry Facts for the Public

As a means of promoting public discussion and an aid to oil men participating in the "Petroleum Promotes Progress" campaign, the Oil Industry Information Committee at 670 Fifth Avenue, New York, is distributing to those participating in the campaign a selection of material designed for local use. The package includes copies of posters, advertisements, leaflets for distribution through service stations and material for radio broadcasts or talks to community audiences.

## Continue Flooding Research

The Pennsylvania Grade Crude Oil Association has renewed its production research agreement with Armour Research Foundation, Chicago, for another year. The research project embraces a fundamental study of the mechanisms by which so-called "wetting agents" might be used to increase the recovery of petroleum by a water flooding process. The objective is to select an agent which is sufficiently efficient and economical for use by oil producers.

## Lane-Wells Transfers Three

J. Murray Walker has been appointed export sales engineer for Lane-Wells Co., Los Angeles, where he will assist in handling foreign trade for the company. He formerly was manager of the Tulsa offices. He is succeeded there by S. W. McGaha, formerly division sales engineer-geologist at Oklahoma City. John M. Terry, formerly at Pampa, has been assigned to the mid-continent division office.

## Extend West Texas Line

Shell Pipeline Corp. and Texas Pipe Line Co. will extend their West Texas crude line from Cushing to Salem, Illinois, via Wood River. The new line will be 20 inch from Cushing to Wood River and 16 inch methods were developed by Armour Research Foundation and use the infrared spectrometer.

on to Salem where it will tie in with The Texas Co. system. The new line will have a capacity of 150,000 barrels daily and will be in operation early in 1949. At present Shell and Texas are building a 20-22-24-inch line from Jal, New Mexico, to Cushing to tap West Texas fields.

## New Rockwell Manager

Ralph G. Caouette has been appointed general manager of the Pittsburgh Equitable Meter division of Rockwell Manufacturing Co. Mr. Caouette formerly was manager of industrial engineering for all Rockwell plants and more recently general manager of the Red Star products division.

## Drucker Joins Catalytic Construction

Joseph J. Drucker has been named manager of the estimating and cost control department of Catalytic Construction Co. Mr. Drucker was associated with Foster-Wheeler Corp. for twenty years, sixteen of which he was the company's chief estimator. During the past four years he has been chief estimator of the oil division of the Arthur G. McKee and Co.

**NEW LABORATORY METHODS** has been developed to enable the Pennsylvania Grade Crude Oil Association to determine whether a specific lubricating oil sample is derived from a Pennsylvania or a non-Pennsylvania crude oil source, it is revealed by W. C. Wenzel, Association executive manager. The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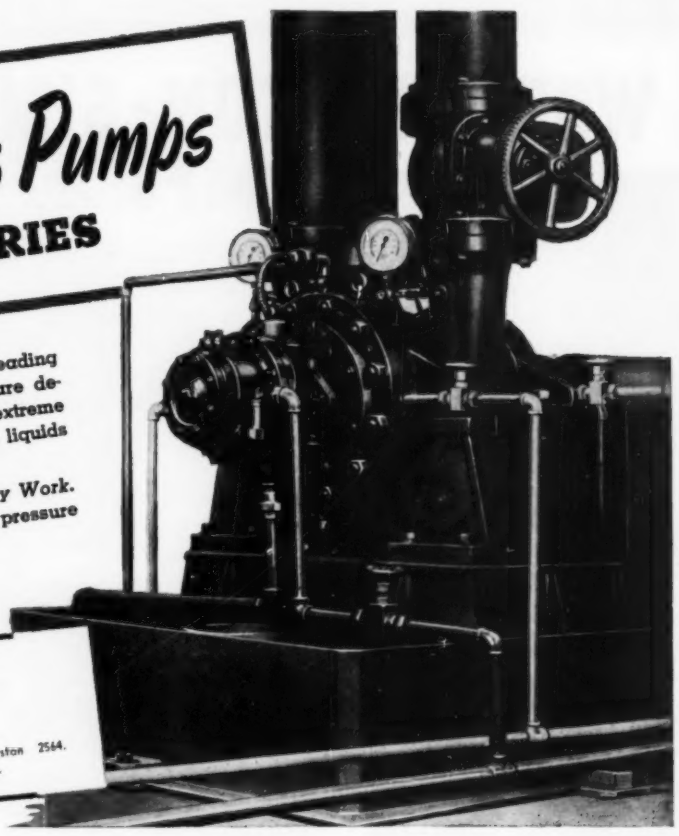

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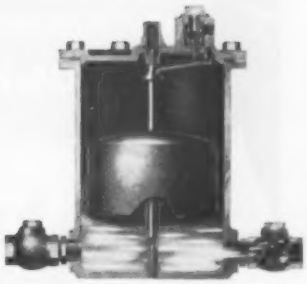

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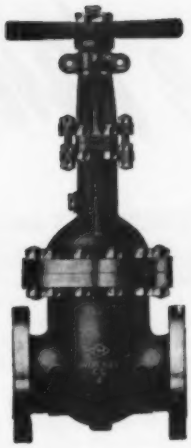

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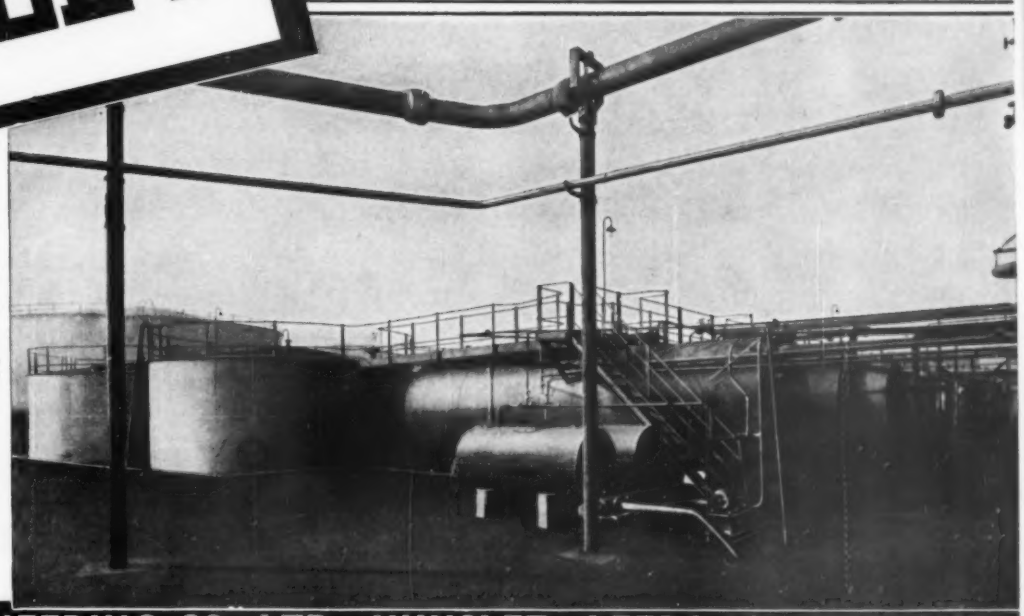

Part of a battery of ten, electrically-welded steel storage tanks 9'0" dia. x 30'0" long with tank in background 25'0" dia. x 10'0" deep. Erected at Ellesmere Port, Cheshire. (Photograph by courtesy of Lobitos Oilfields Ltd.)

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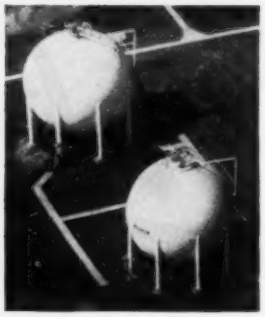

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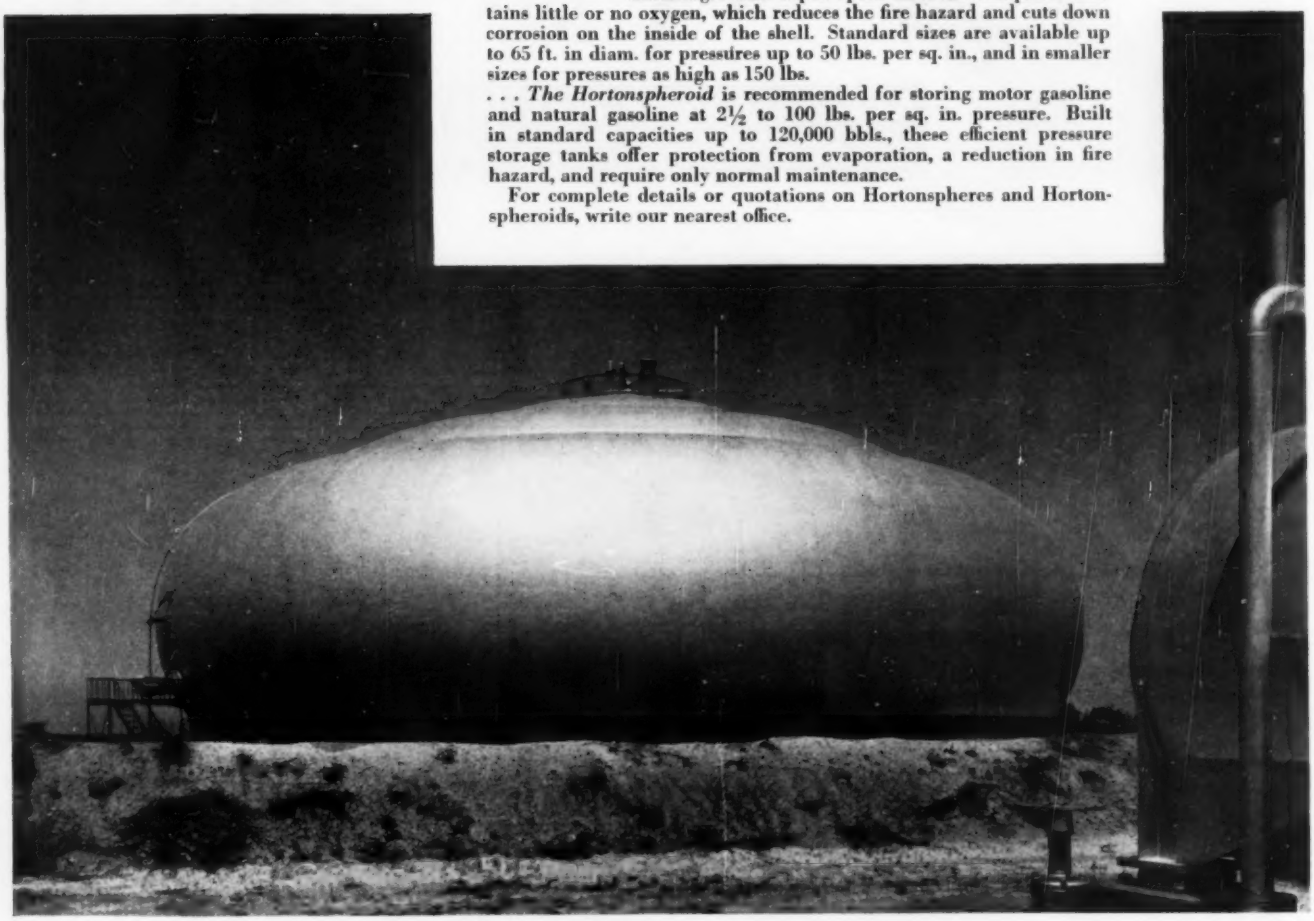

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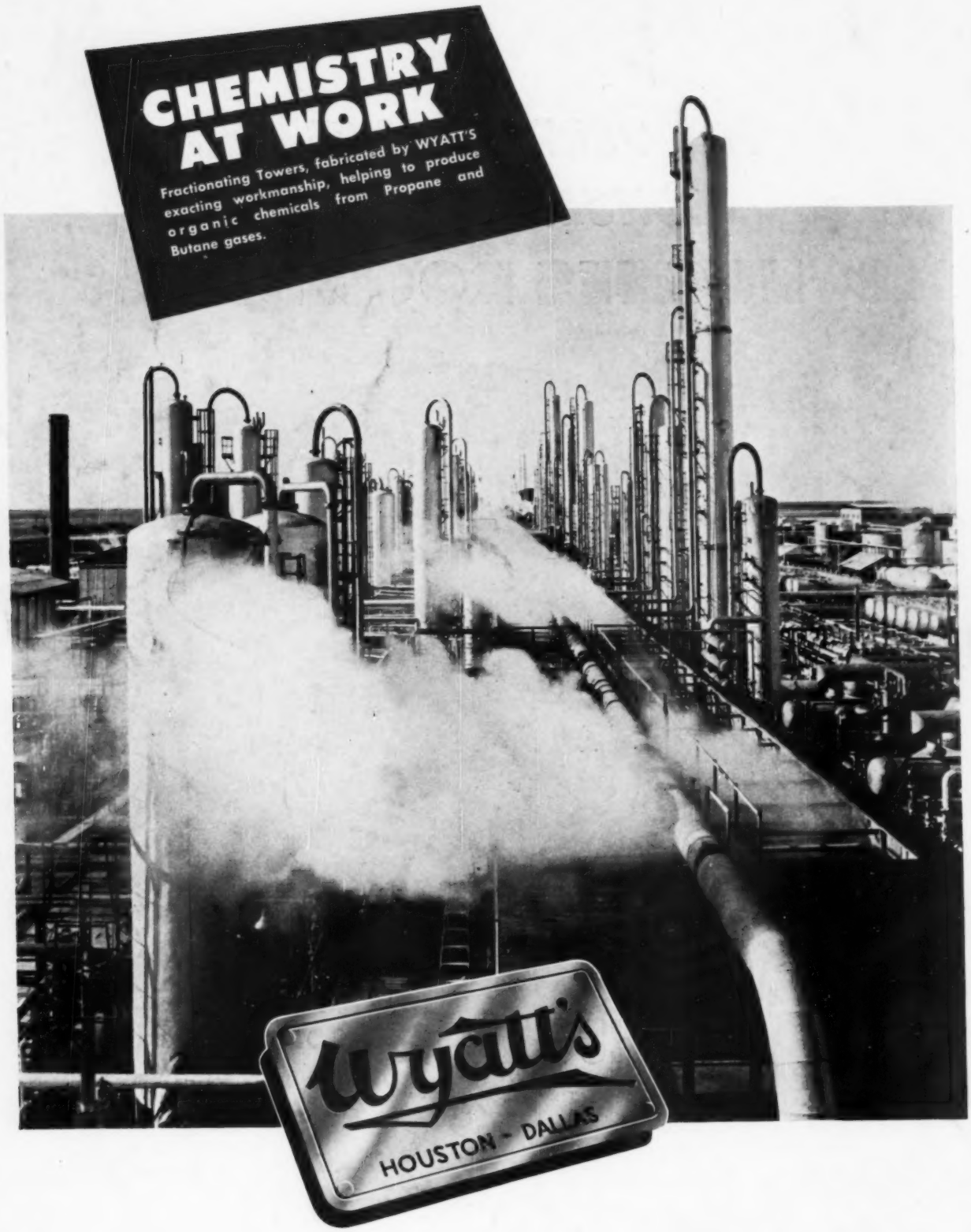
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